POPULAR SCIENCE

MONTHLY

MECHANICS AND HANDICRAFT

25¢

April

Wilbur Shaw's Report on Chevrolet

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How to Help Build a House

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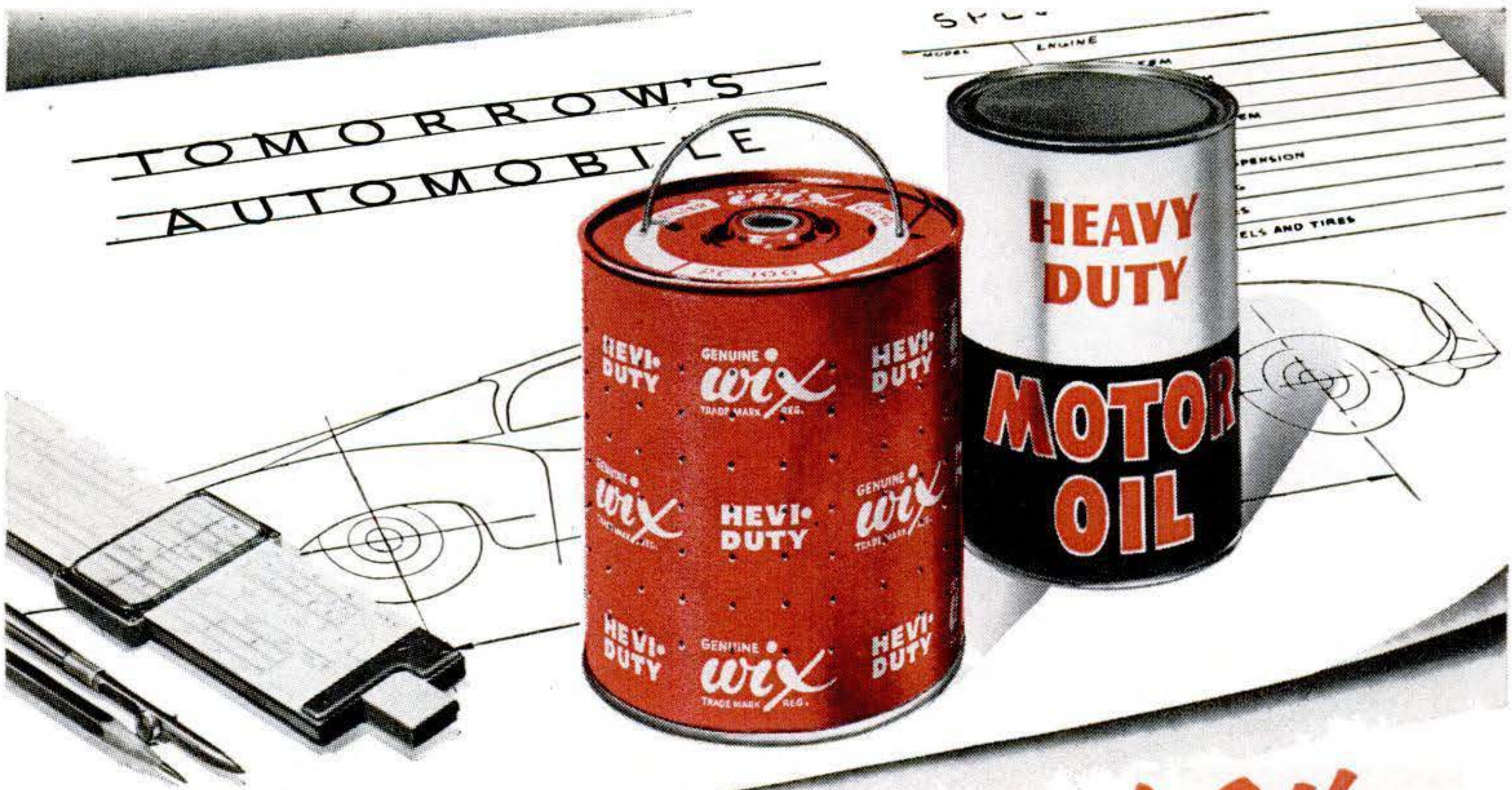

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Mechanics and Handicraft

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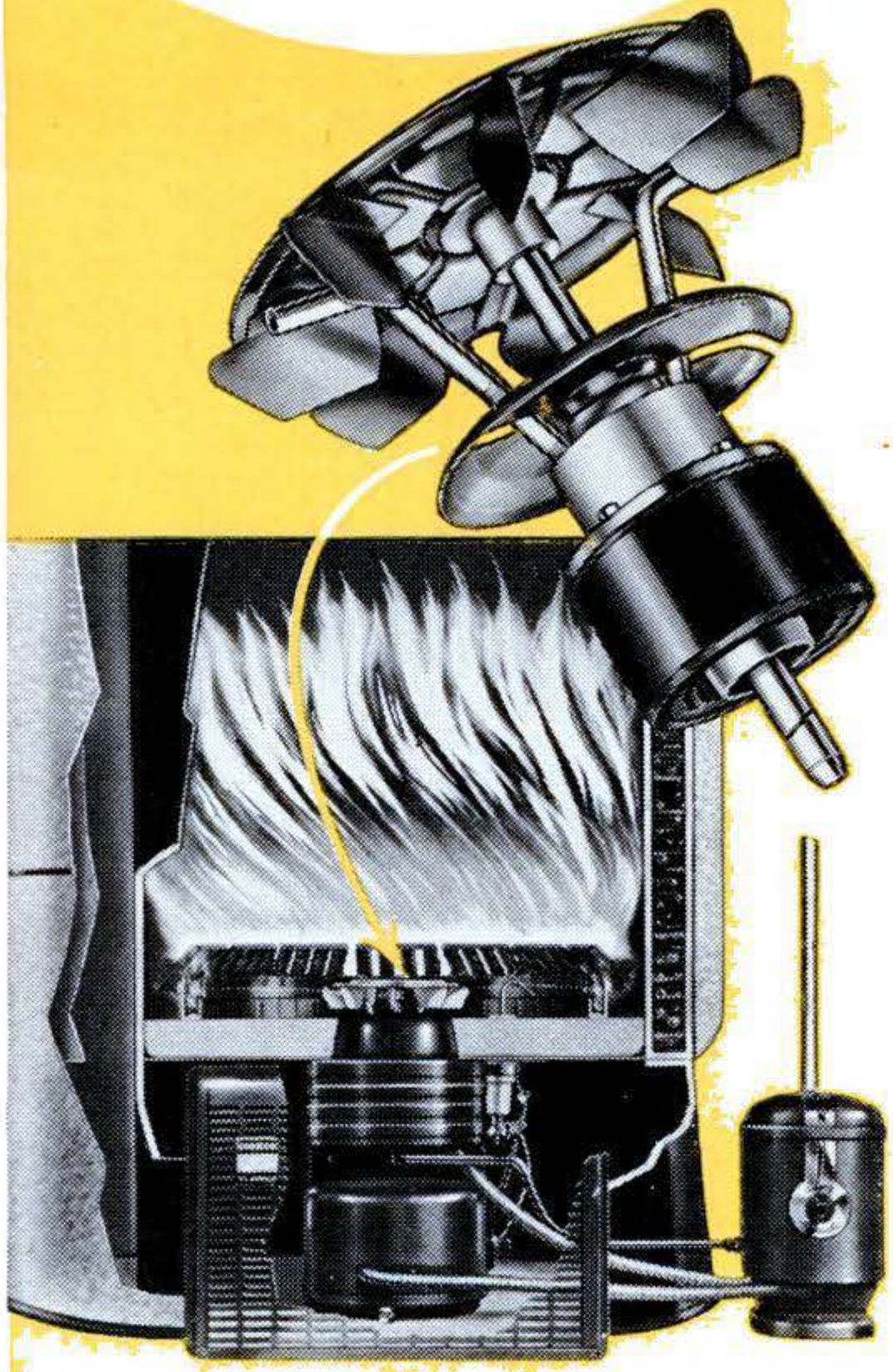

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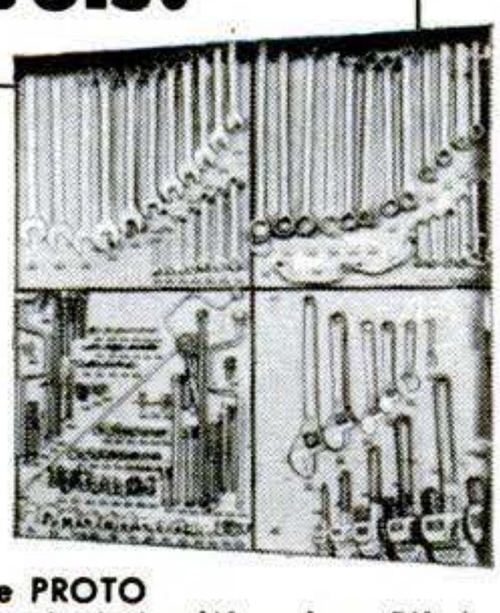

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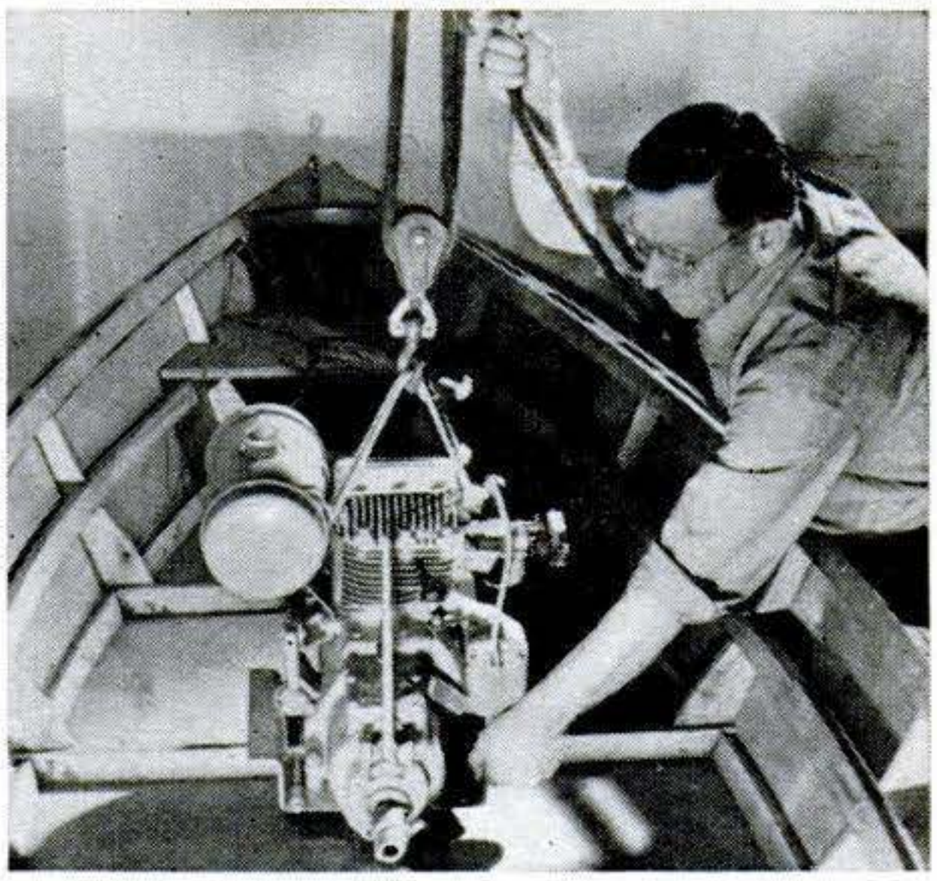
NEXT MONTH . . .

Installing an Inboard Engine



One of the small inboard power plants will turn a rowboat into a reliable fishing boat—always there and ready to go. The May issue will show you in step-by-step photos how to install an air-cooled engine. You can do all the work yourself.

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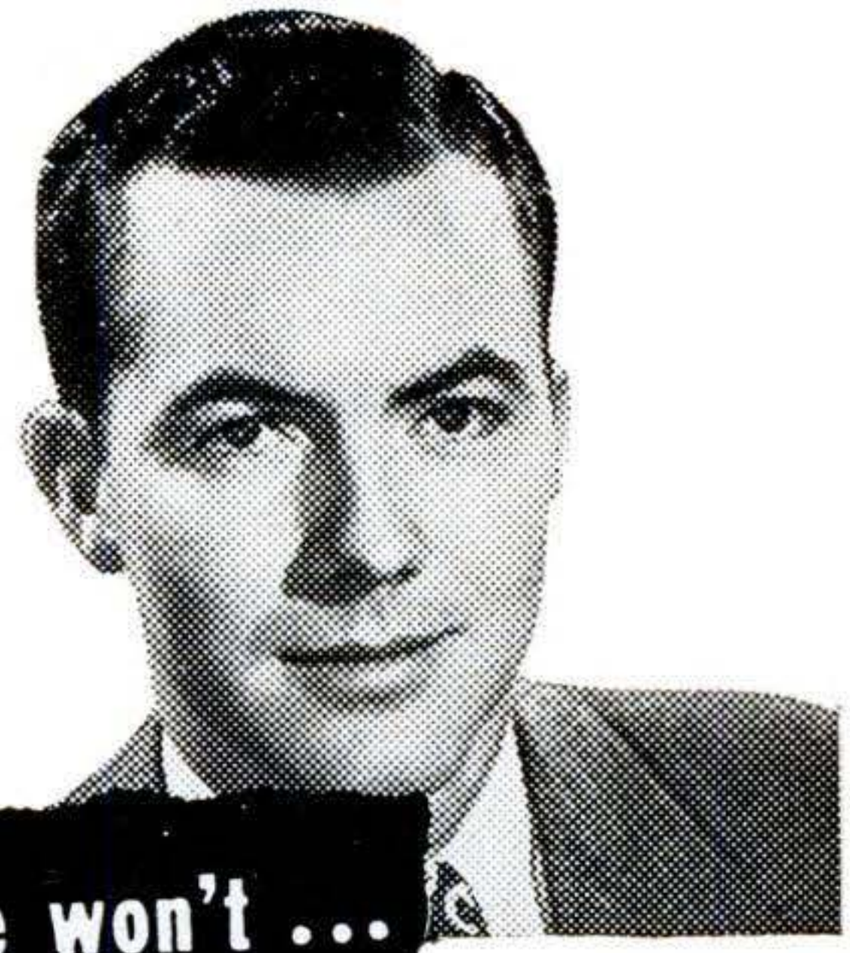

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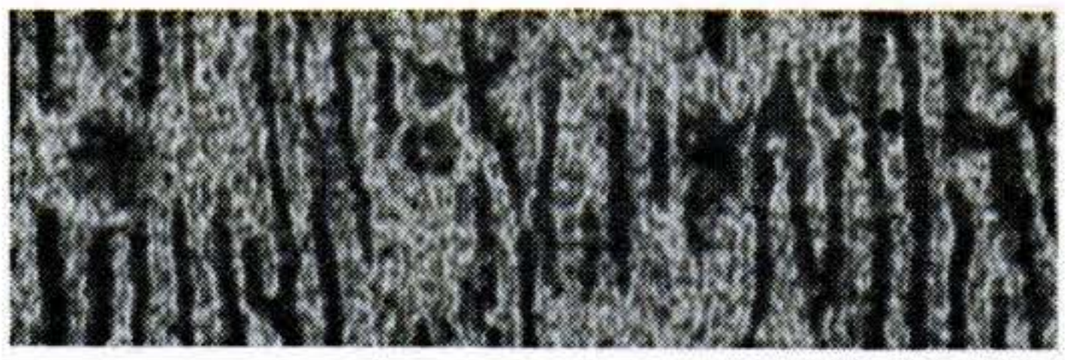
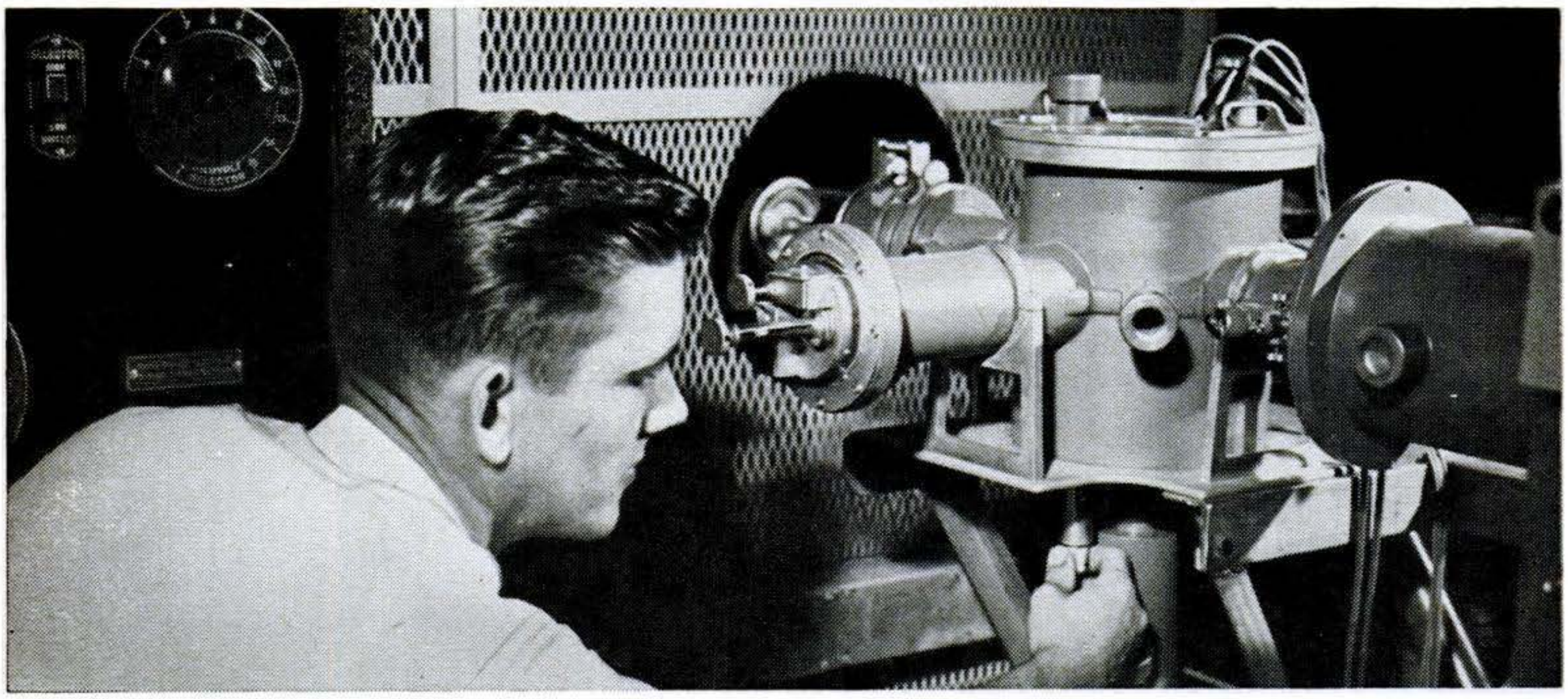
Electrons probe the future

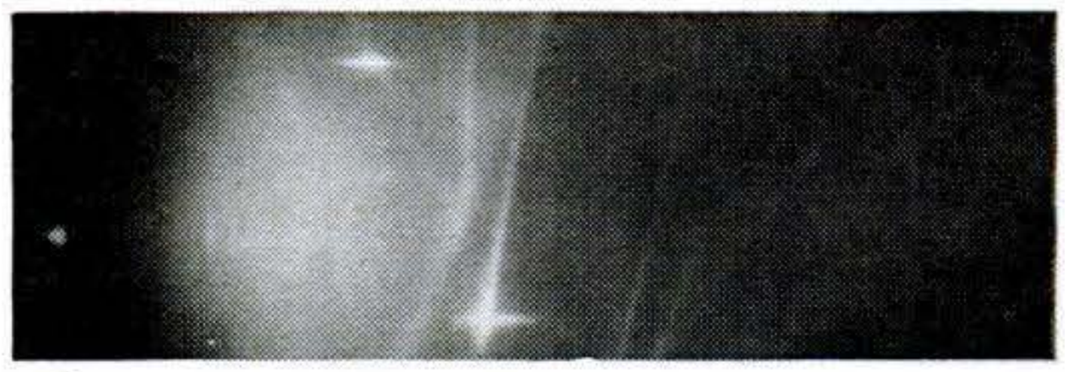
1 Electron micrograph of an alloy of aluminum, nickel, cobalt and iron. Magnification 20,000 diameters.



2 Cooled from high temperature in a magnetic field, the alloy becomes a powerful permanent magnet. Note changed structure. Black bars reveal formation of precipitate parallel to the applied field. Each bar is a permanent magnet.



3 A Bell scientist adjusts electron diffraction camera. Electrons are projected on the specimen at glancing angles. They rebound in patterns which tell the arrangement of the atoms . . . help show how telephone materials can be improved.



4 Diffraction pattern of polished germanium reveals minute impurities which would degrade the performance of a transistor.

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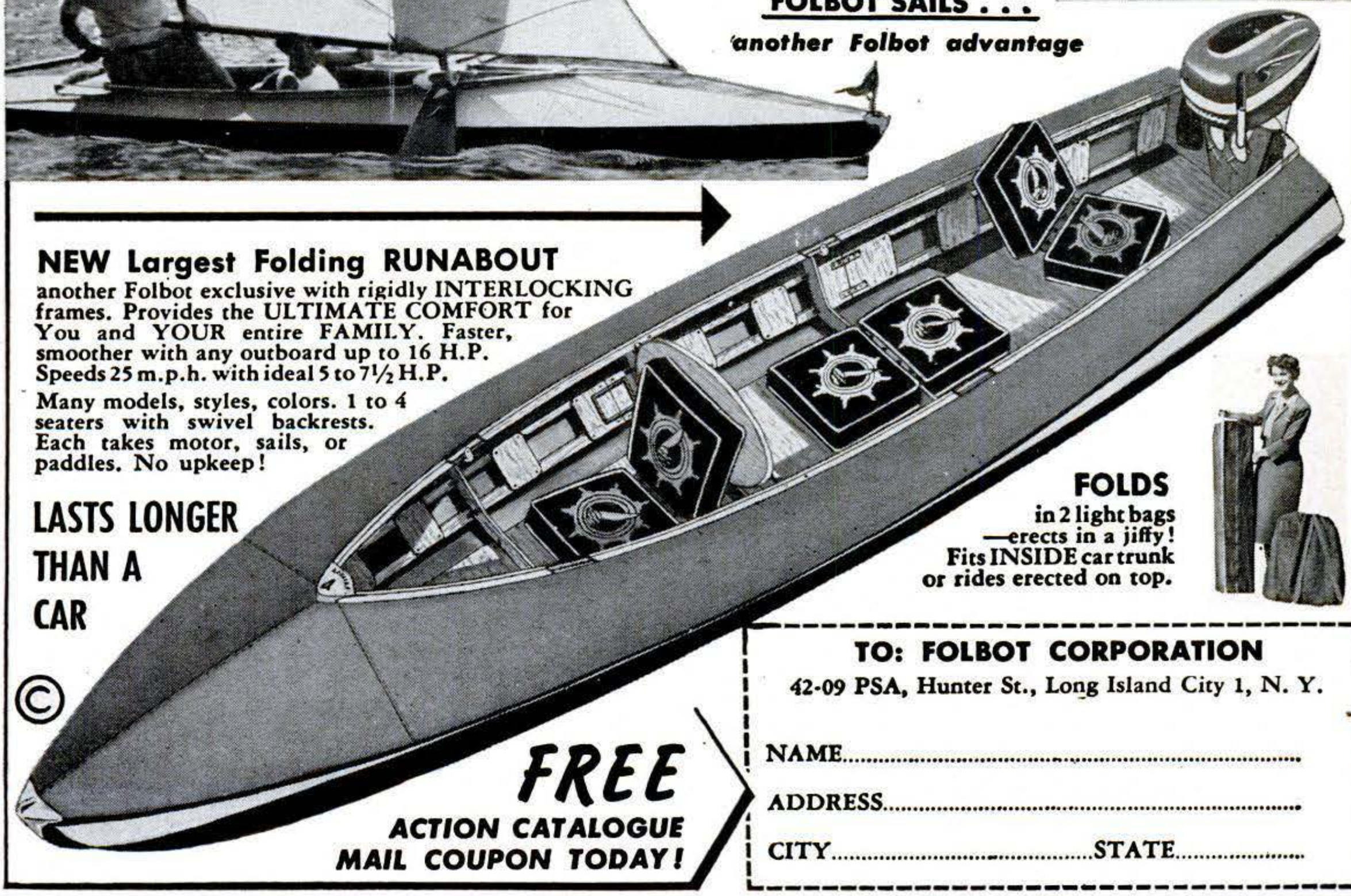

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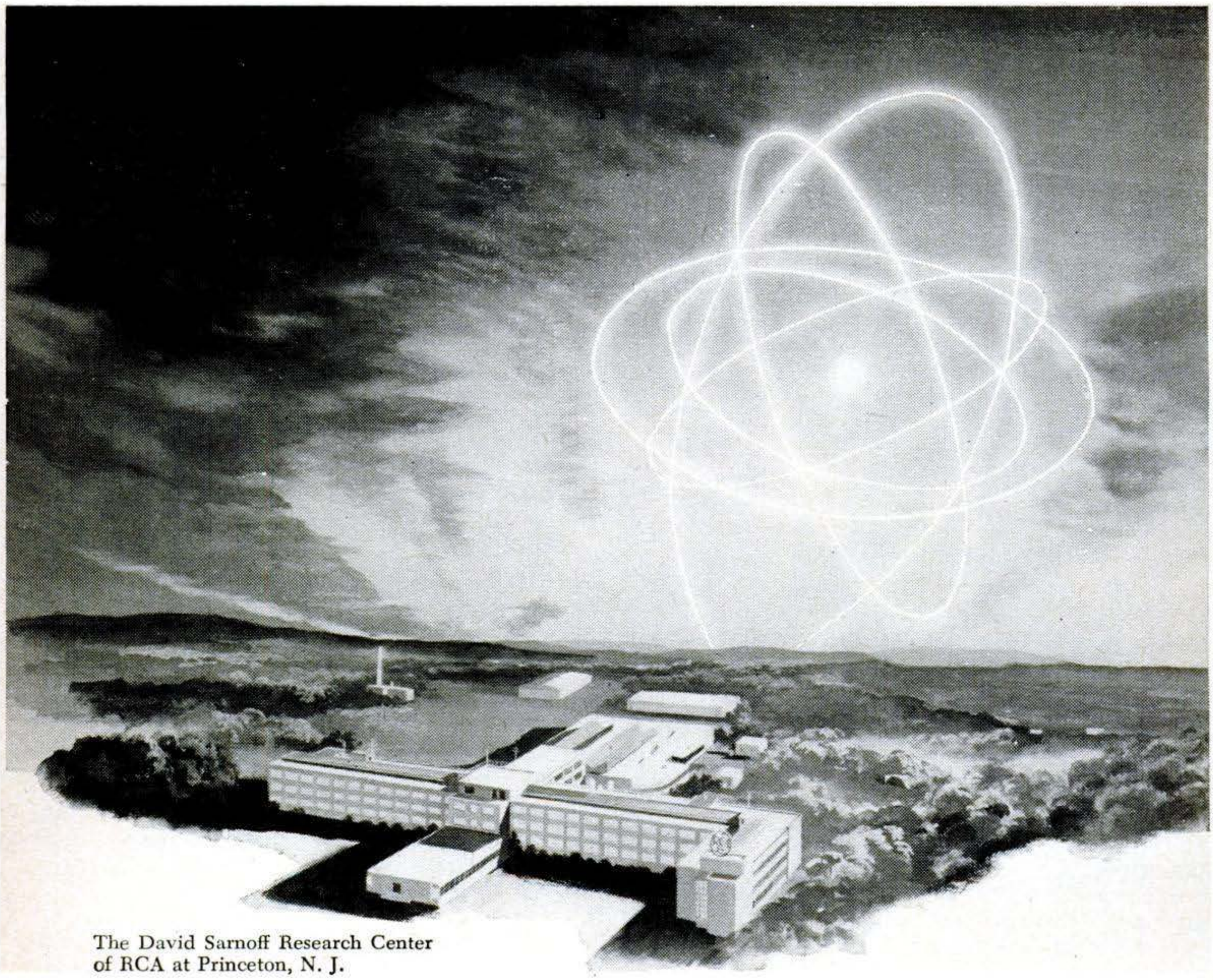

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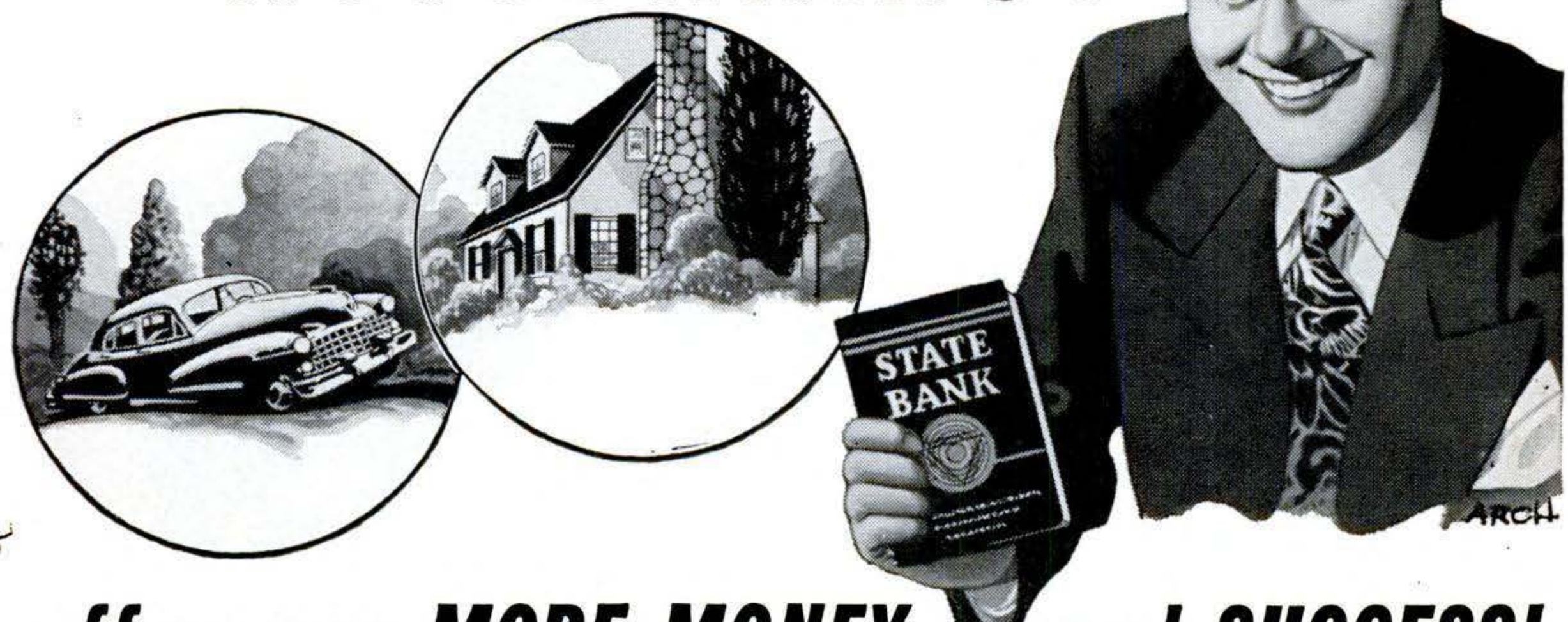

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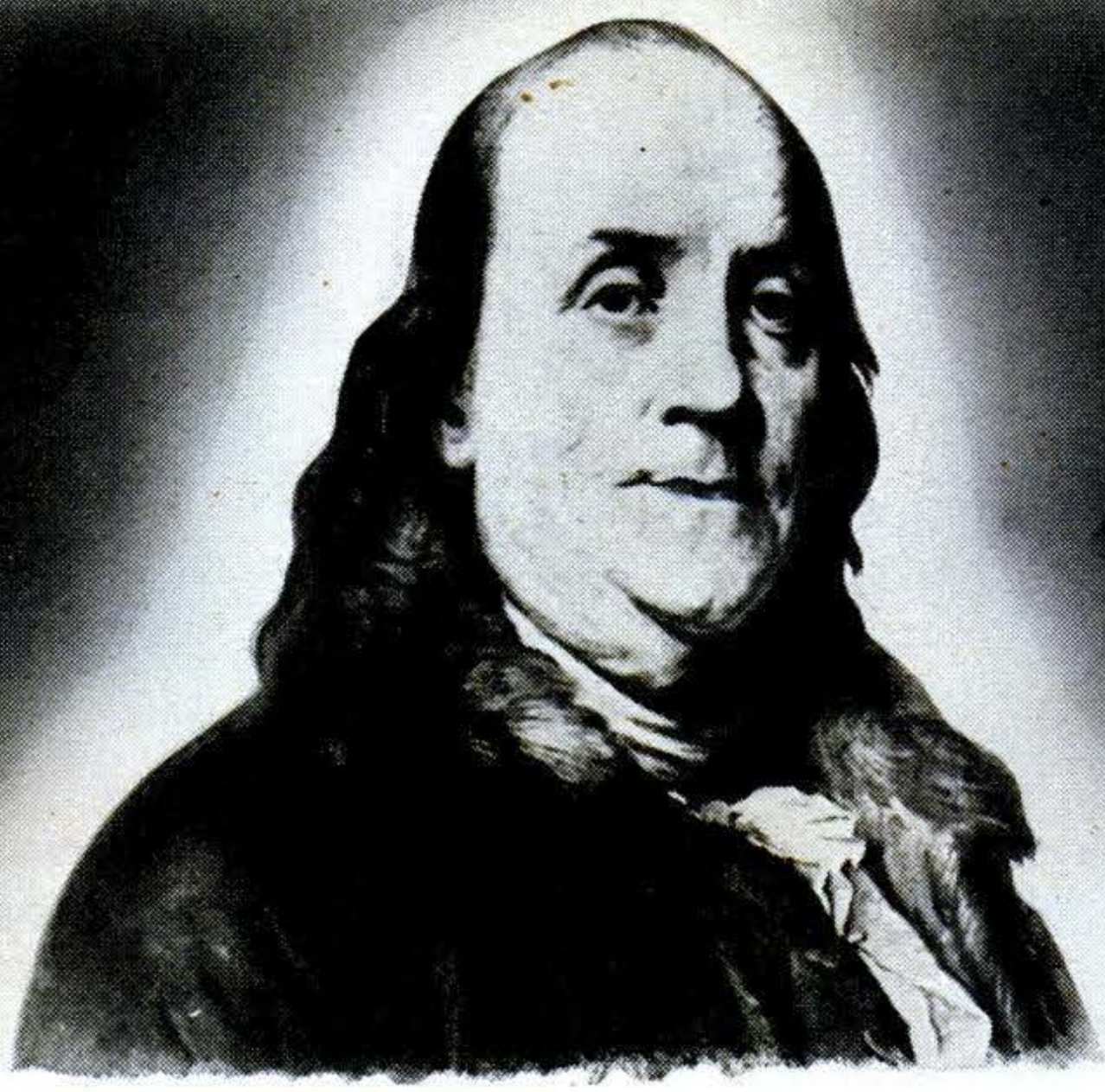

Benjamin Franklin
(A Rosicrucian)

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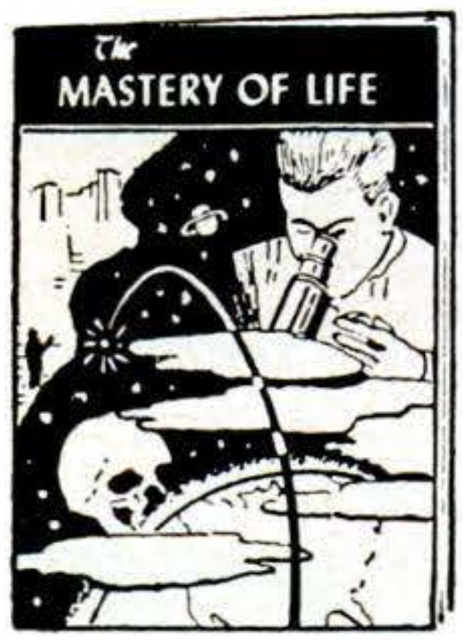

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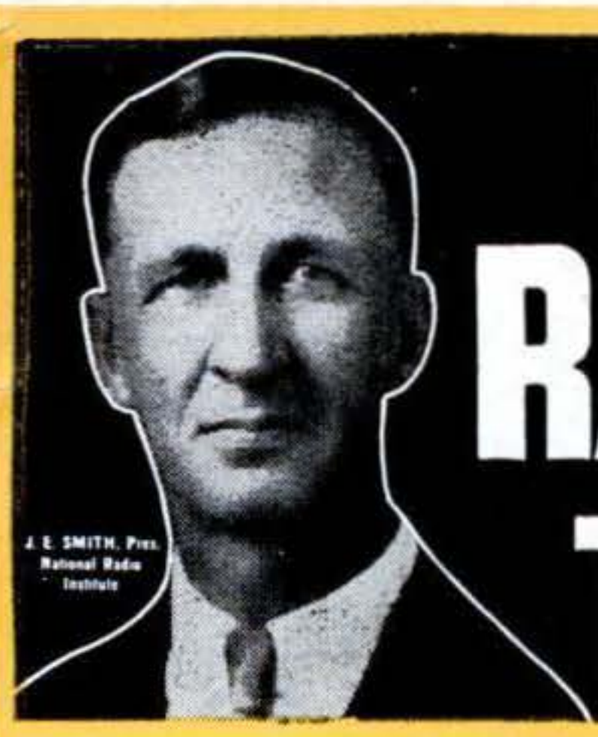

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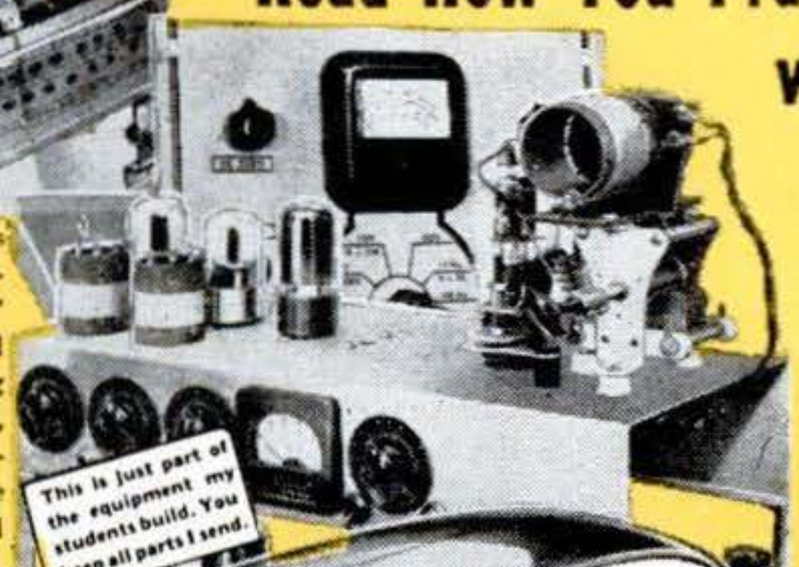

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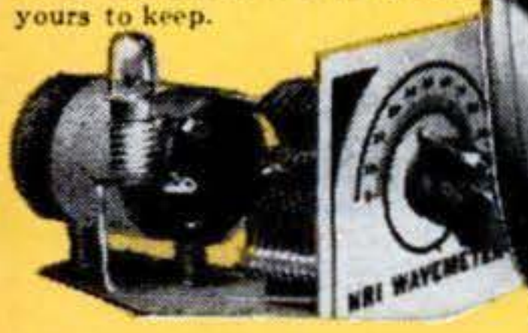

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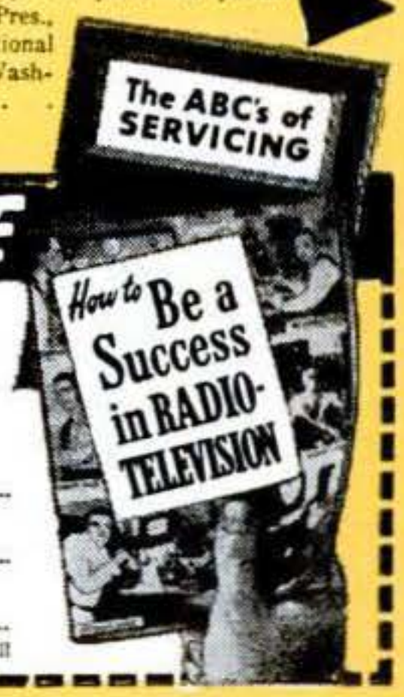

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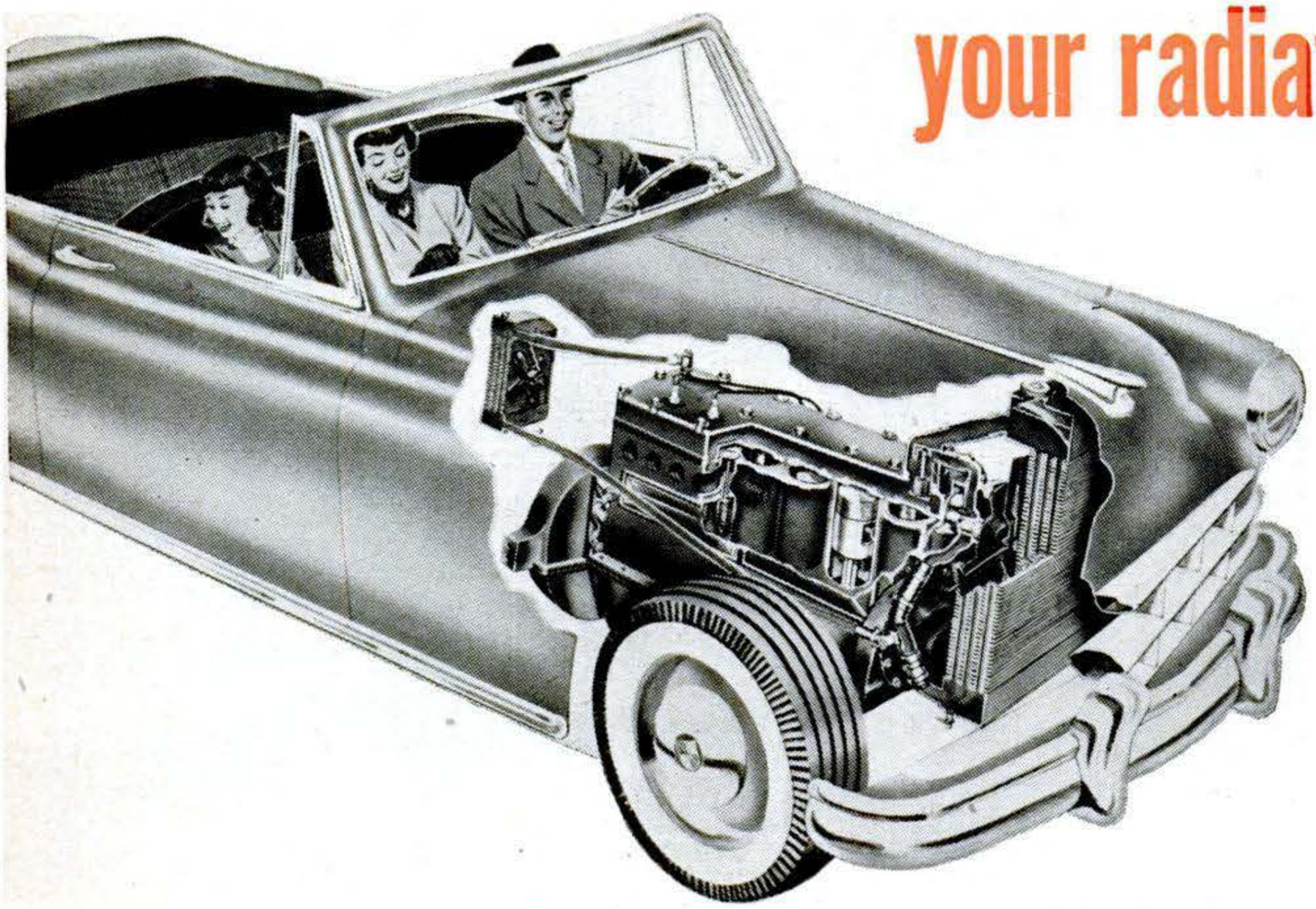

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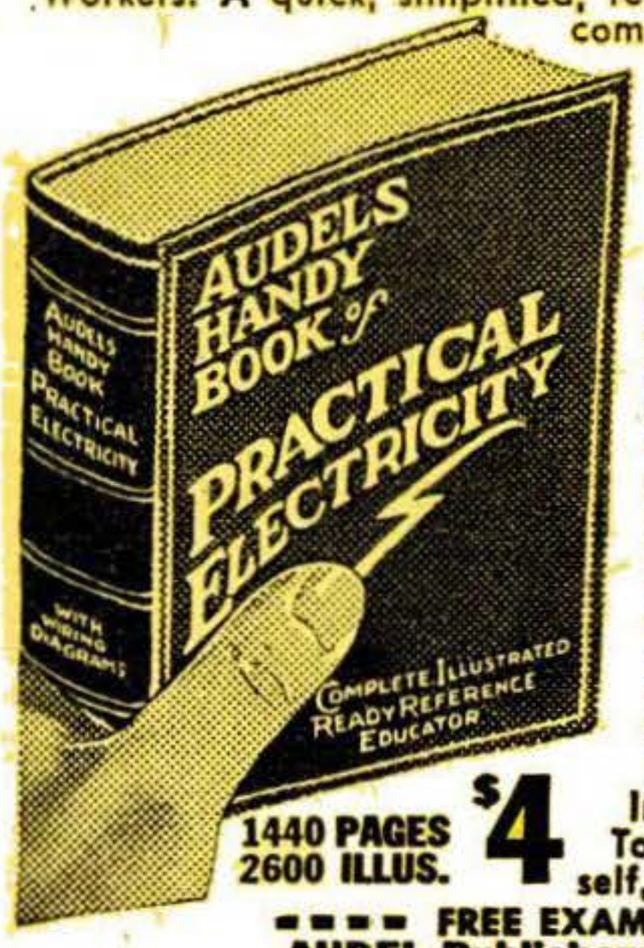

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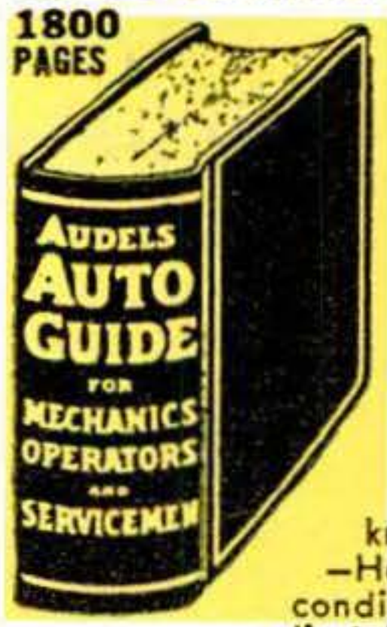

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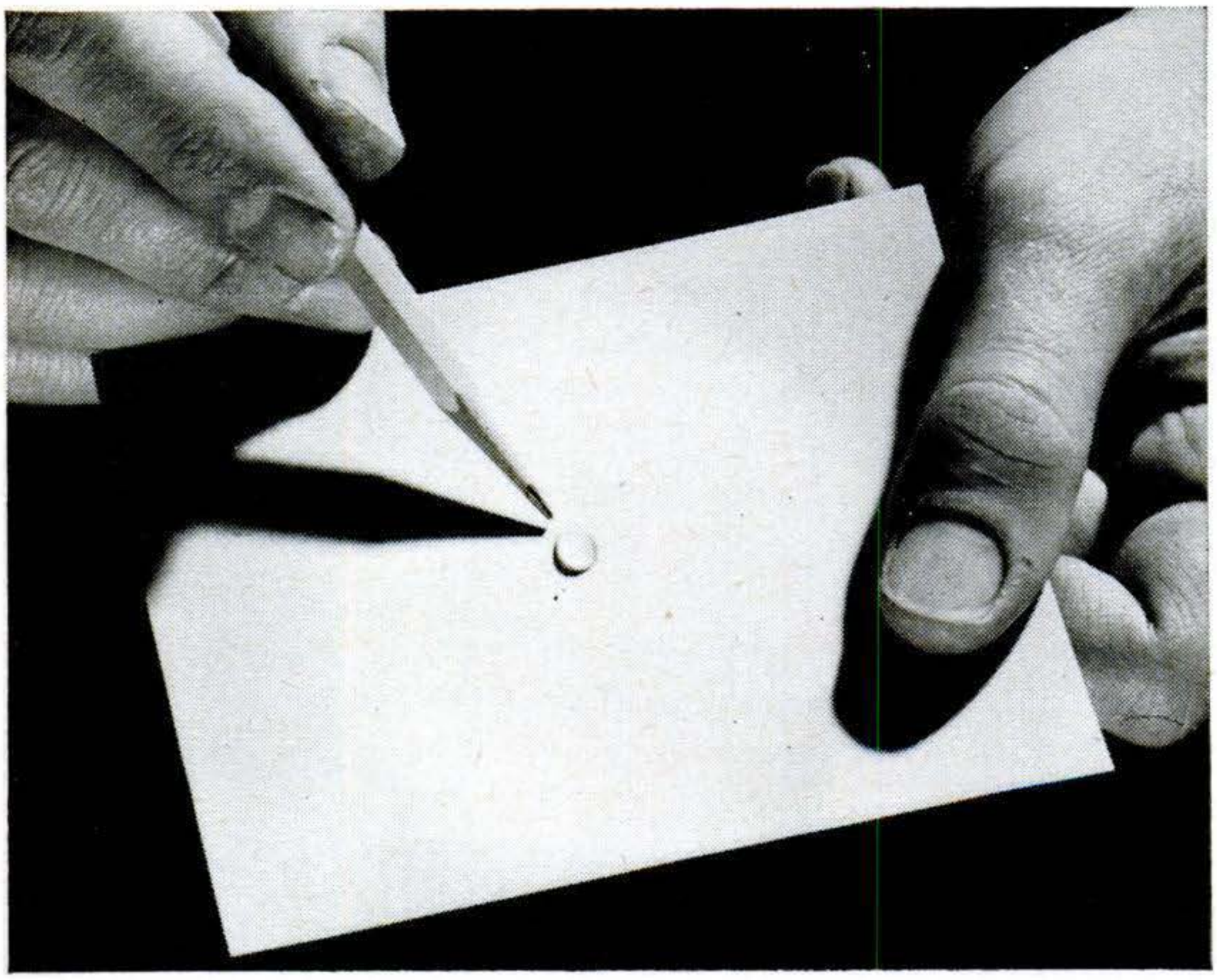

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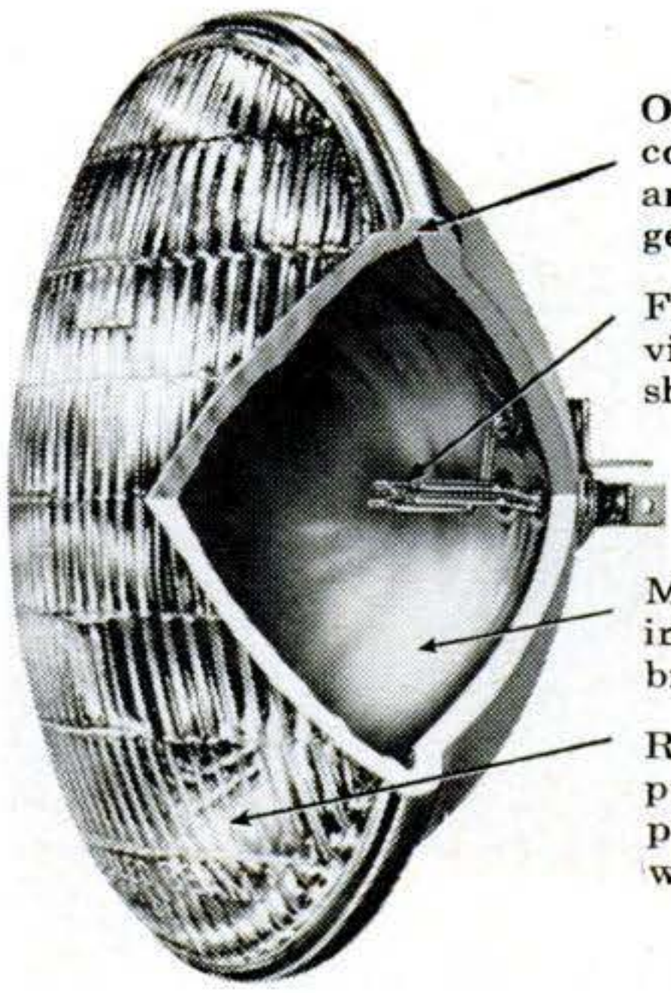

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Letters

Dr. Einstein Replies To a PSM Reader

I would like to know the progress being made on Albert Einstein's new theory of gravitation in which he attempts to interrelate all known physical phenomena into one all-embracing formula. He said some time ago it would solve the secret of the universe, so I was wondering why this great scientific achievement wasn't continuing front-page news.

Has any practical experiment been started on it yet?

FRED KAPLAN, Far Rockaway, N.Y.

POPULAR SCIENCE MONTHLY *passed along reader Kaplan's question to Dr. Einstein. His reply follows:*

It is not my fault that laymen obtain an exaggerated impression of the significance of my efforts. Rather, this is due to writers of popular science and in particular to newspaper correspondents who present everything as sensationally as possible.

Let me now answer your question. By generalizing the relativistic equations of gravitation, i.e. by a purely mathematical procedure, I tried to find simple relativistic equations for the total field. While doing this I was hoping that the equations obtained in this measure should hold in the real world.

In order to decide whether or not this is true it was necessary to find solutions of the equations, representing empirically known facts. So far I have not been successful in my endeavours, nor has anybody else, so that it is completely impossible to tell whether or not the theory is "true." The reason for this situation lies in the complexity of the mathematical problem.

Let me draw a parallel in order to illustrate the situation to an outsider.

Newton's theory of planetary motion is based on Kepler's empirical laws of planetary motion around the sun. These relatively simple laws are comparatively exact because the mass of the sun is large; the masses of the planets, however, are relatively small so that the interaction of the planets hardly affects their motion. Newton hypothetically assumed his laws of motion of solid bodies under the influence of attracting forces.

It is a theory consisting of a few startlingly simple assumptions. In order to show that this theory was correct it was necessary for him to compute the planetary paths corresponding to these hypotheses so that he could decide whether or not these computed paths agreed with the paths obtained from Kepler's empirical results.

The computation of the paths from the simple hypotheses of the theory was a difficult mathematical problem and Newton's genius succeeded in its solution. Thus Newton's theory had been confirmed.

If, however, the planetary system consisted of bodies of virtually equal masses, all at approximately equal distances from each other, their paths would be so complicated that neither their true shape could be determined and characterized empirically nor computed from the elements of the theory. If such a situation prevailed we might perhaps never know whether or not Newton's theory holds.

ALBERT EINSTEIN,
The Institute for Advanced Study
Princeton, N. J.

1872 . . . 1952 . . . 2032

EIGHTY years ago next month Edward Livingston Youmans put out the first issue of POPULAR SCIENCE MONTHLY. PSM for May will recall some other things that happened in 1872—and show you a glimpse of a few of the things to come in the next 80 years.

E. L. Youmans

Fire-Fighting Wolves

The little item you reprinted in January from POPULAR SCIENCE MONTHLY of 75 years ago about the ravages of wolves in Russia reminded me of a story told by my father, who came from there. He and a couple of other boys, it seems, were camped by a stream one night. While seated around their campfire, they were surprised by a

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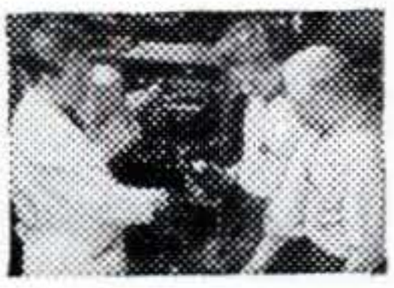

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pack of wolves. Instead of attacking the boys, the wolves—who mortally hate fire—leaped into the stream, scrambled out dripping wet, ran up to the campfire one after another—and shook themselves violently in an attempt to put out the fire. Perhaps this seems farfetched, but I have never known my father to lie.

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WILLIAM A. GREINES, Wasco, Ore.

Quite a Haul

That big coal-burning locomotive in your March issue [p. 150] has more pull than a police chief's brother-in-law, but for heaven's sake what's the right answer to the number of cars it can haul. I tried counting them but got derailed a couple of times and had to start all over. Finally came up with a tally of 199 cars, but a friend of mine insists he got only 192. How about giving us the official score?

SEWARD L. BUCKNER, Cincinnati.

You're right on the nose with 199. The official count is 199-plus, the plus being a little piece of a car accidentally left over on page 153. Incidentally, we made quite a haul ourselves—of letters—on that teaser. The answers ranged all the way from 189 to 201 hopper cars. Some of the cars were partially hidden by the "gutter" along the inside margin of the pages, unless you opened the magazine up real wide. That could be the "margin of error." And several people must have counted the water tender and/or the caboose. Anyway we hope we never have to sit out that particular train at a railroad crossing.

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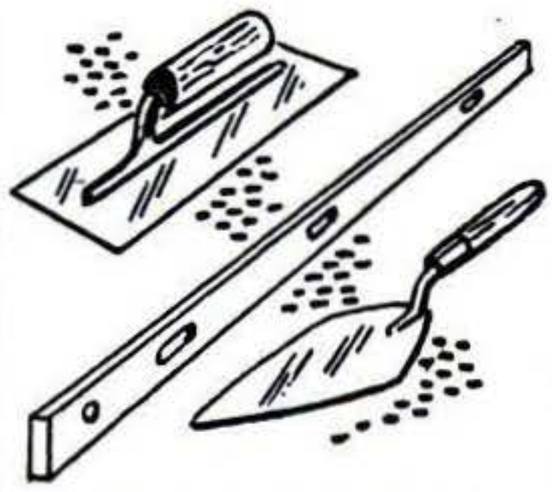

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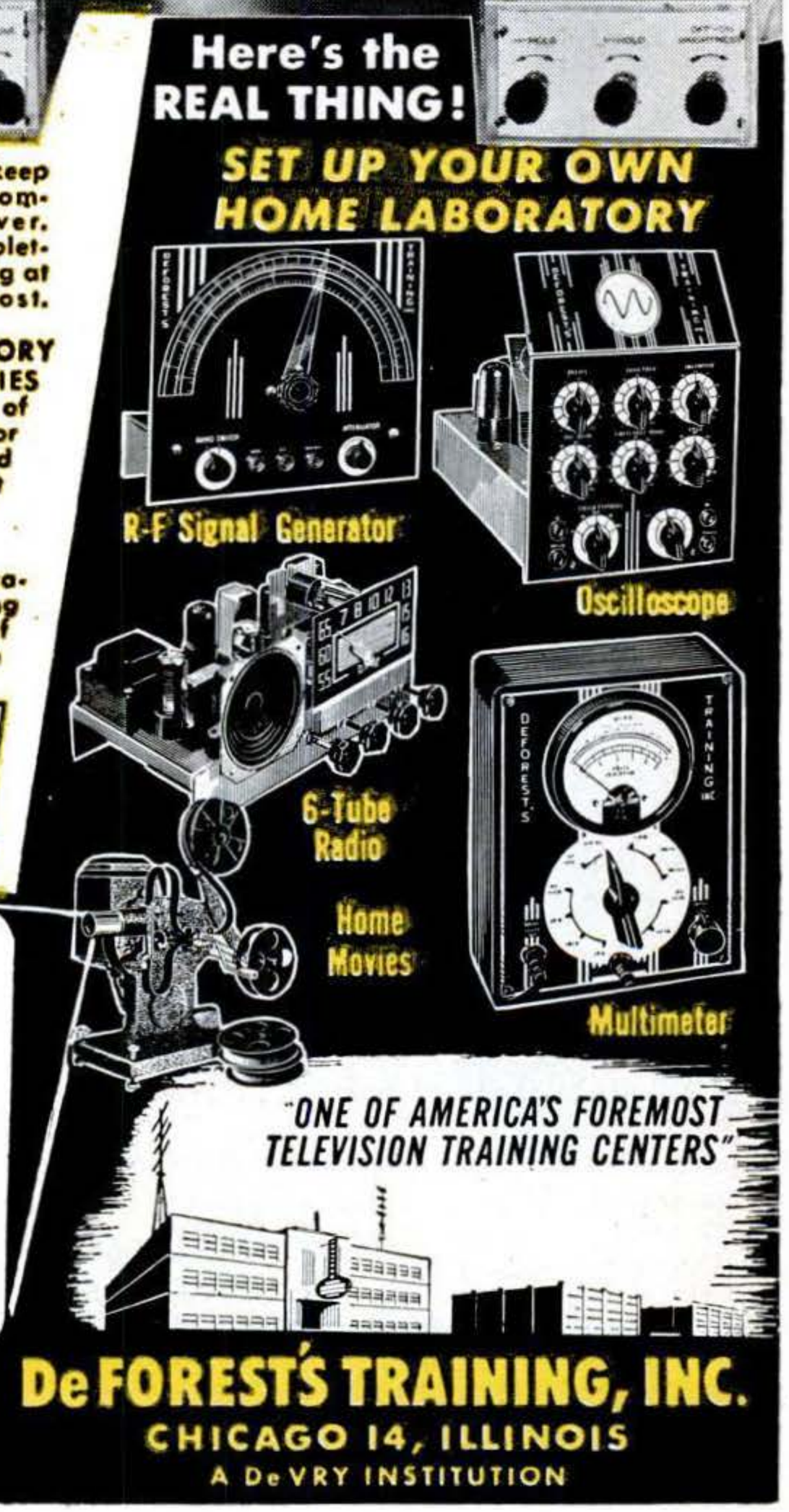

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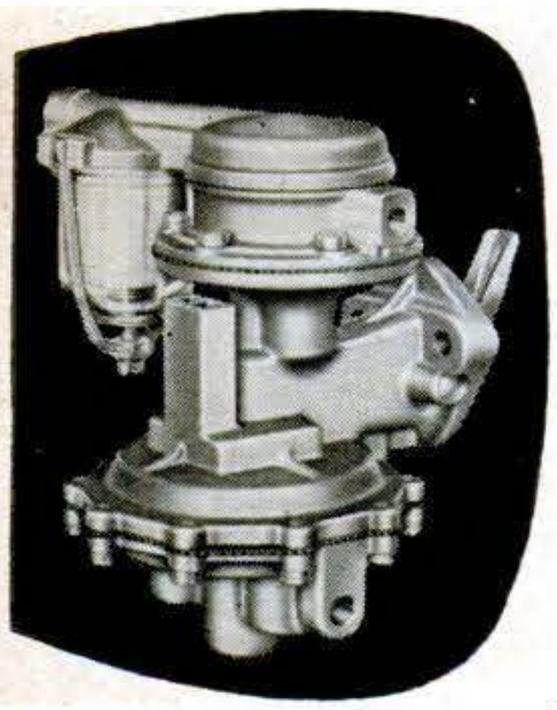

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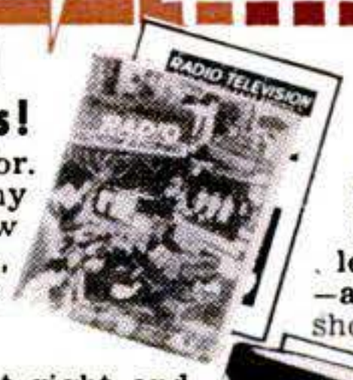

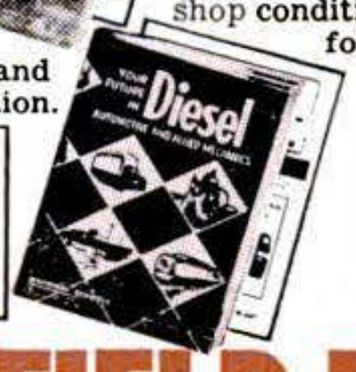

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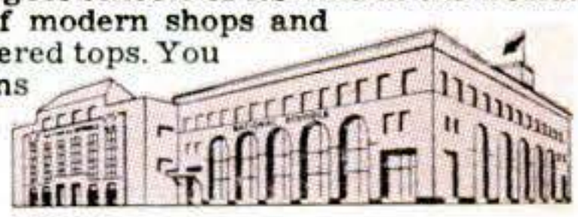

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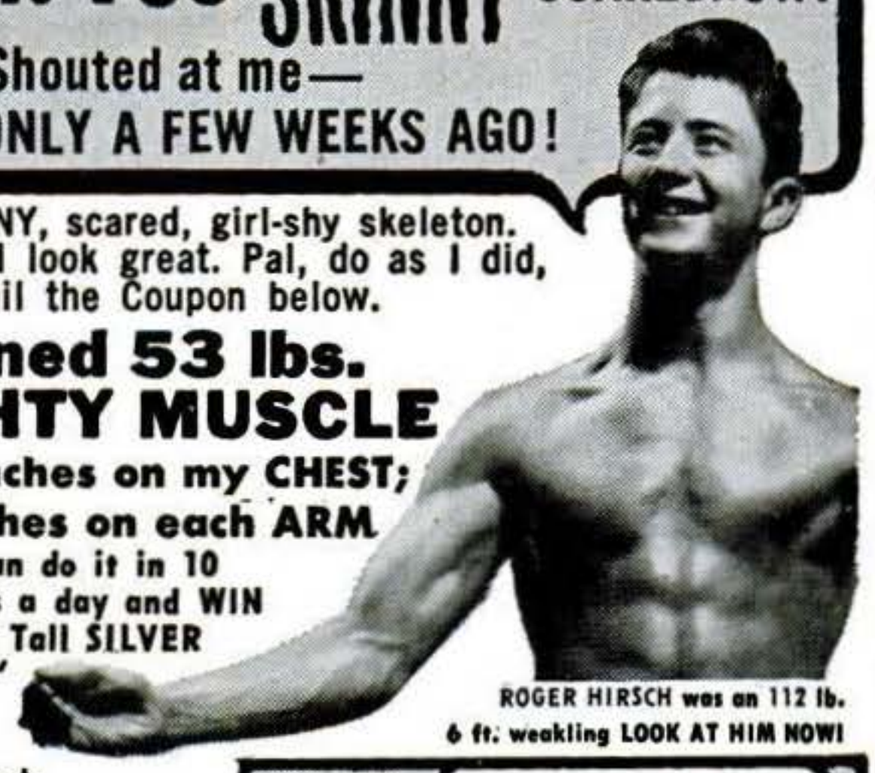

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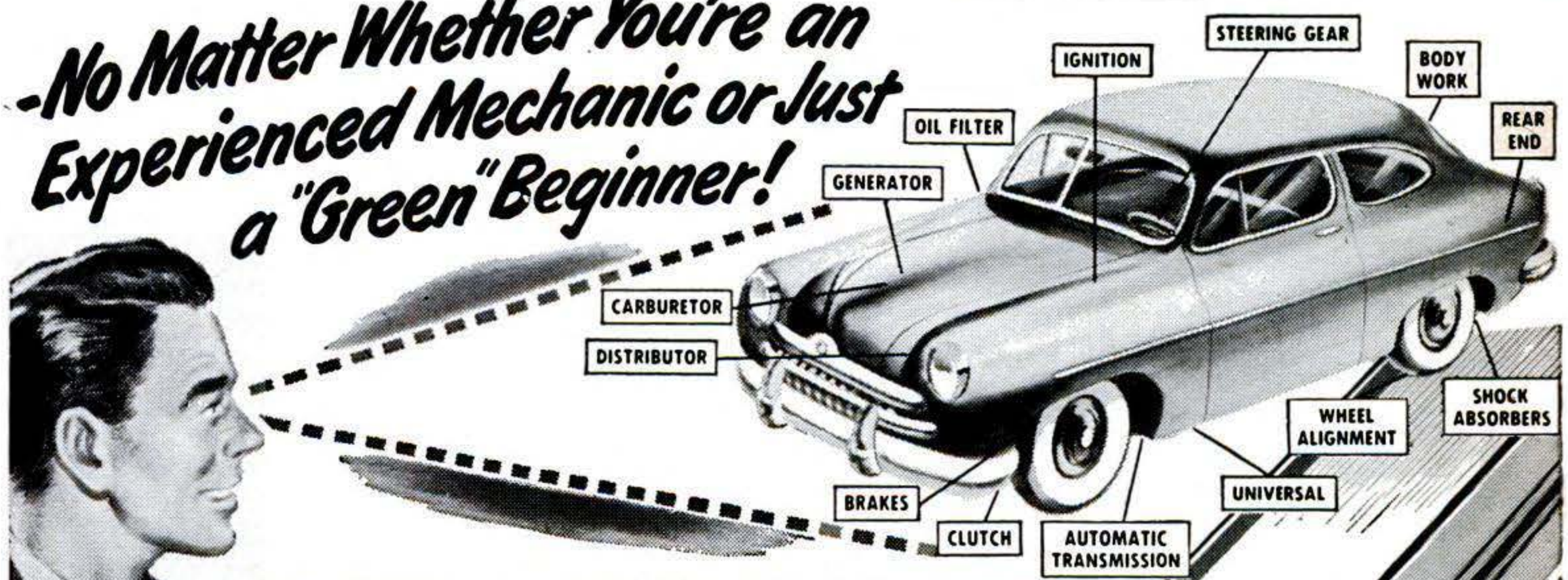

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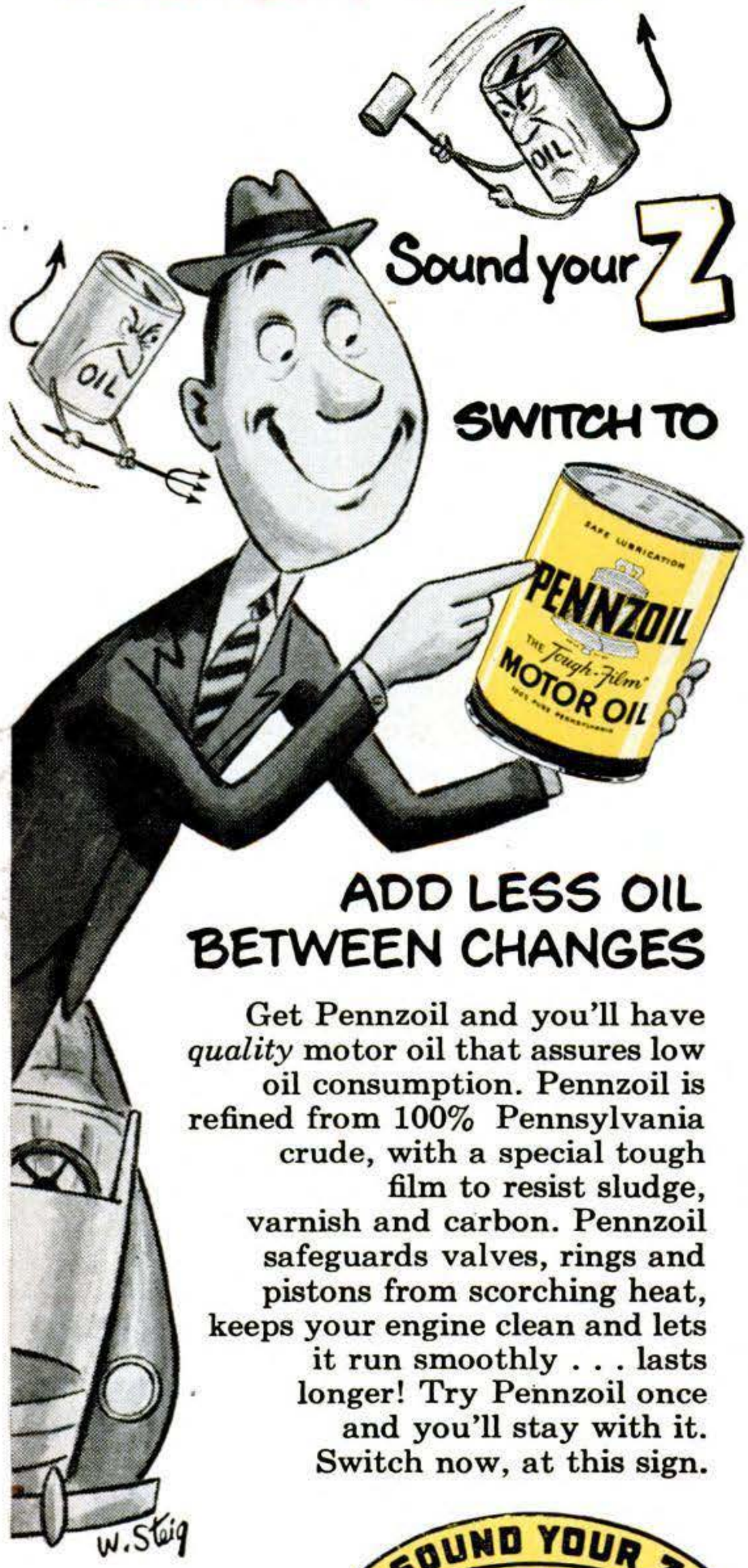

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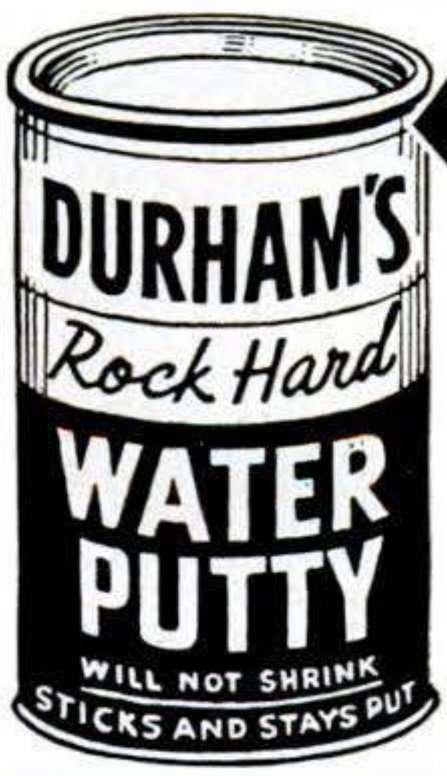

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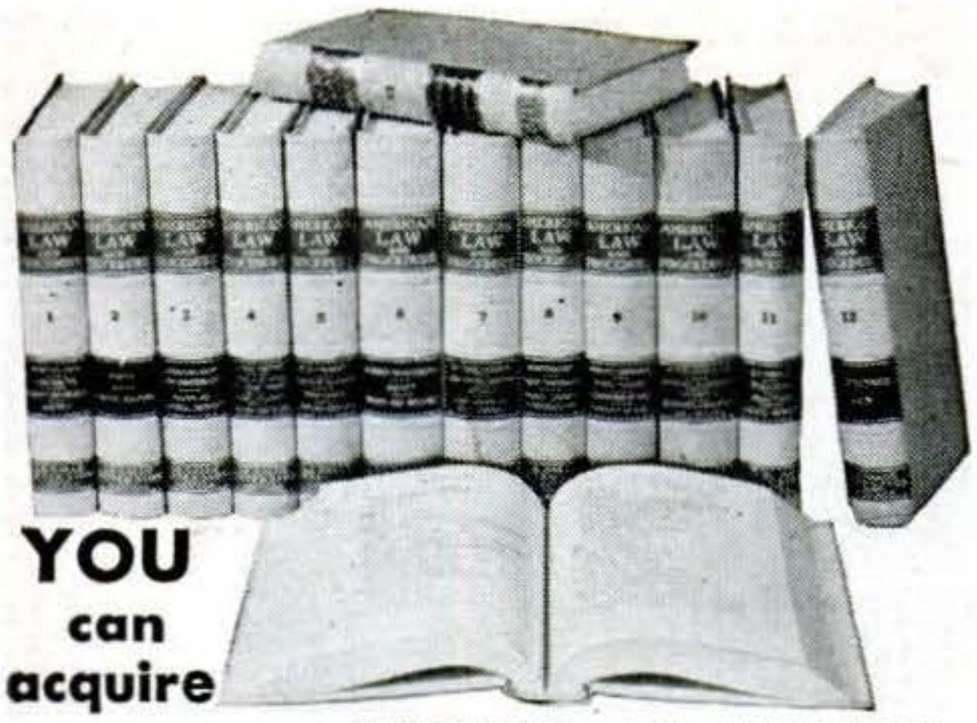

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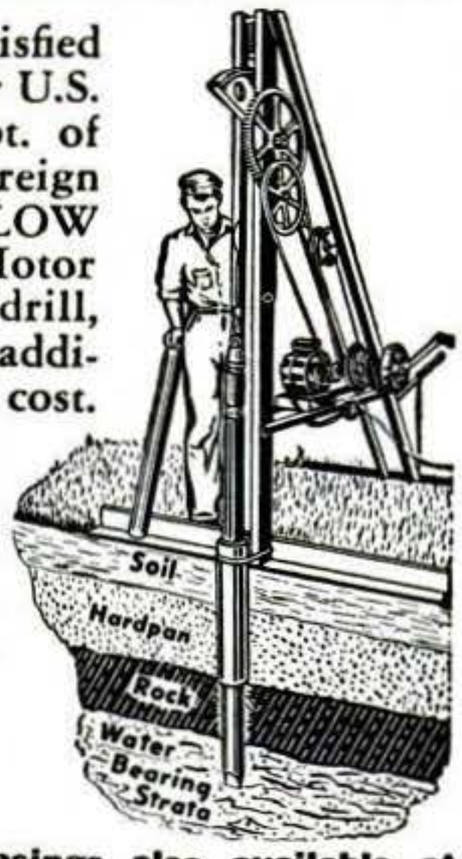

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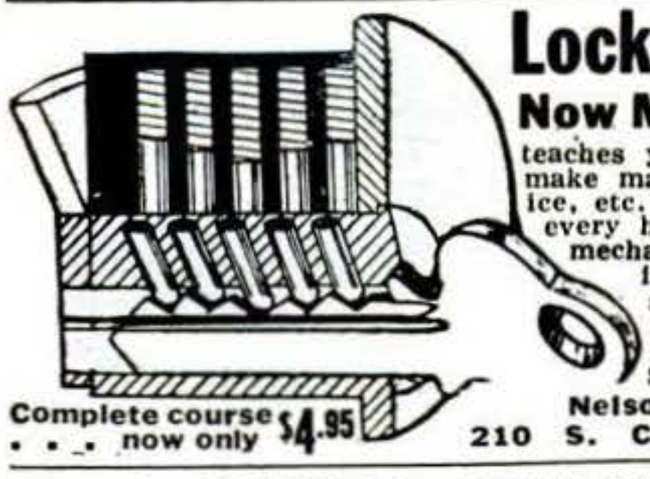

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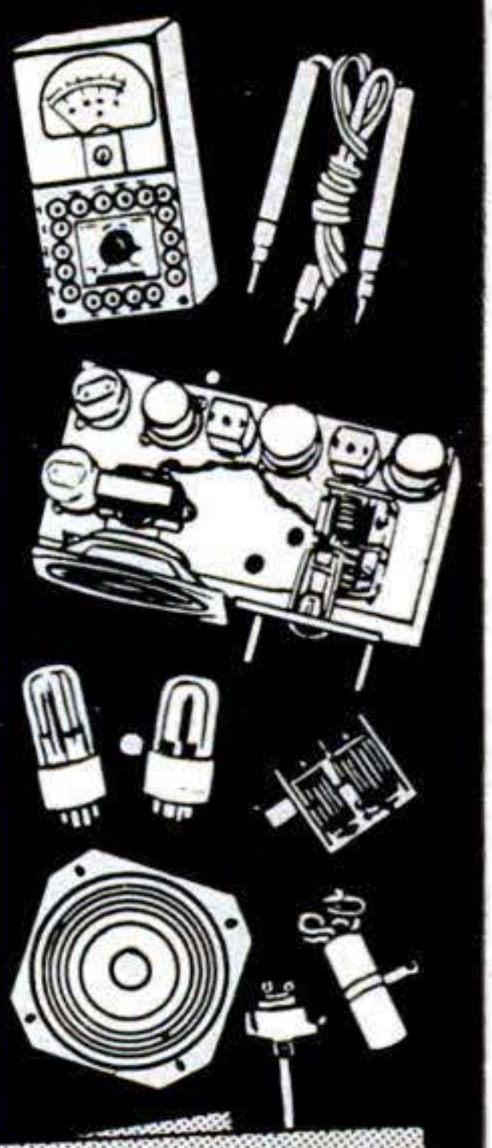

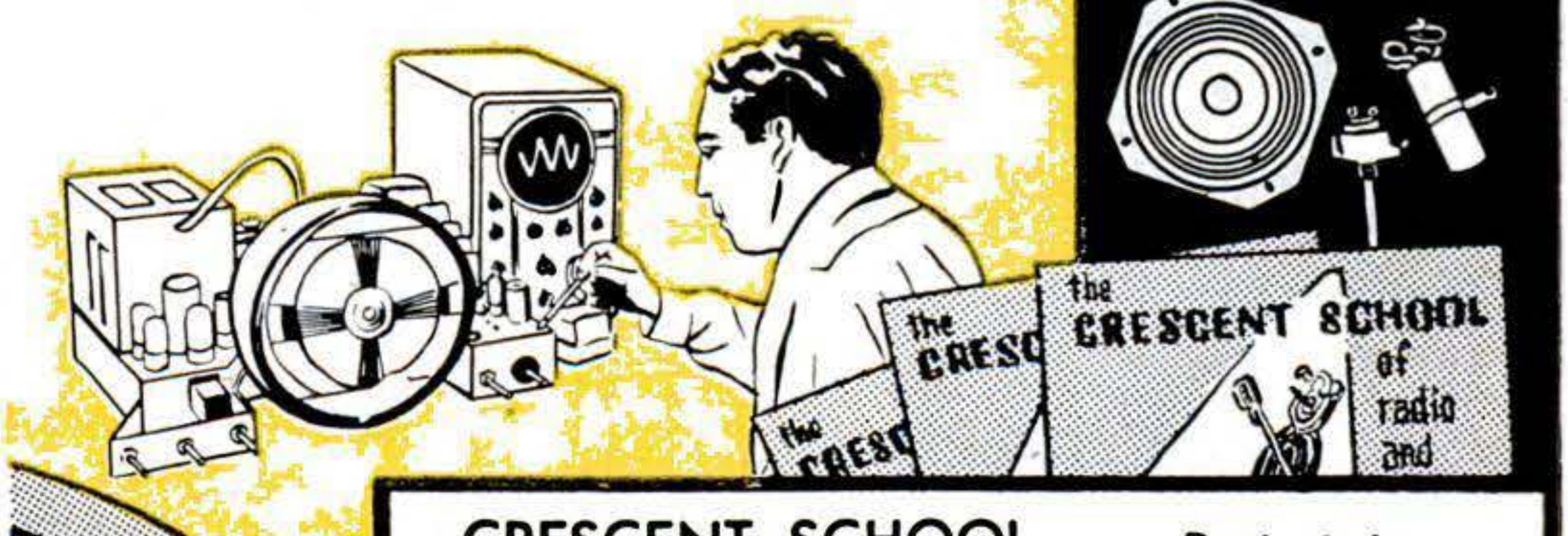

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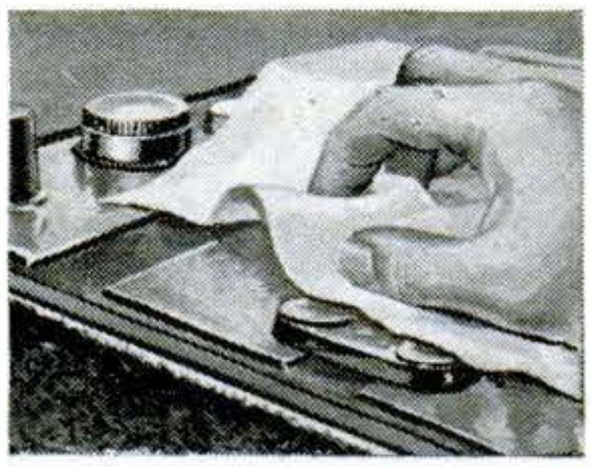

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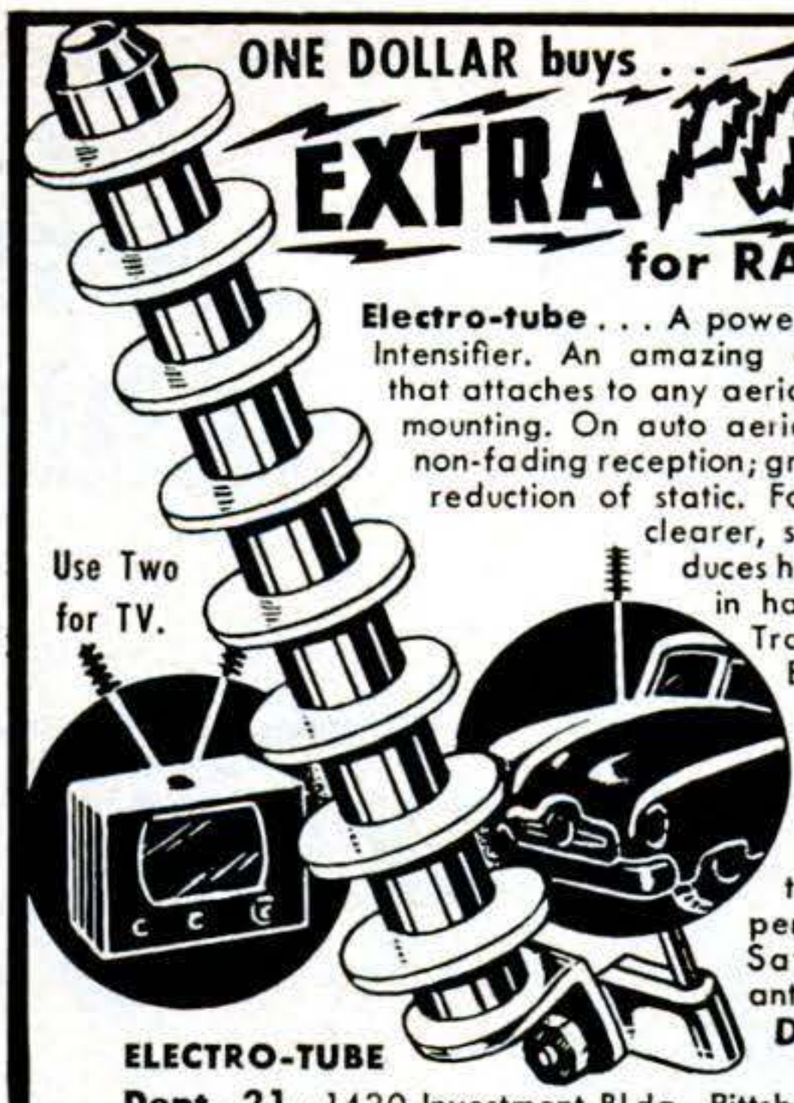

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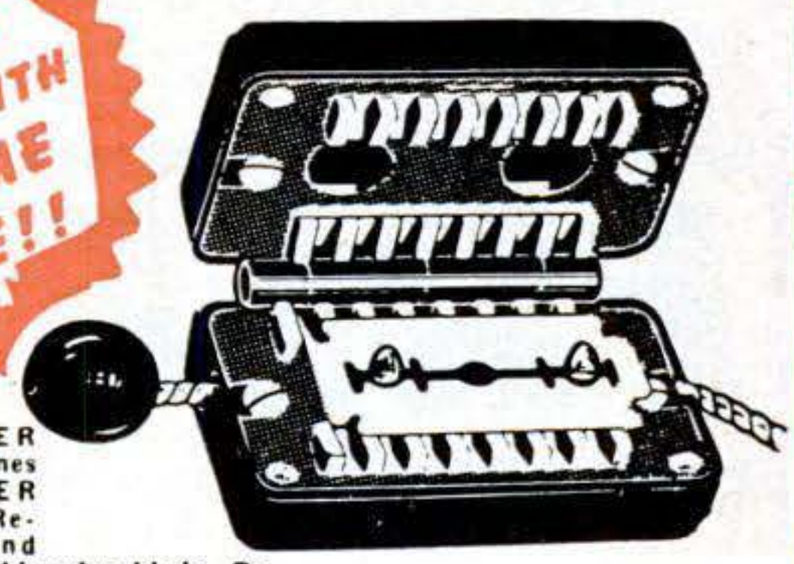

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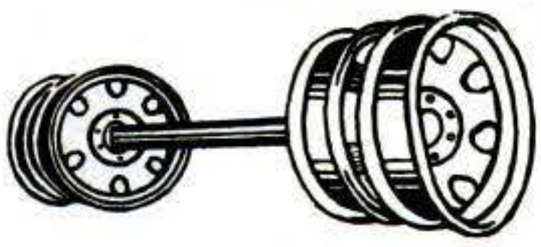

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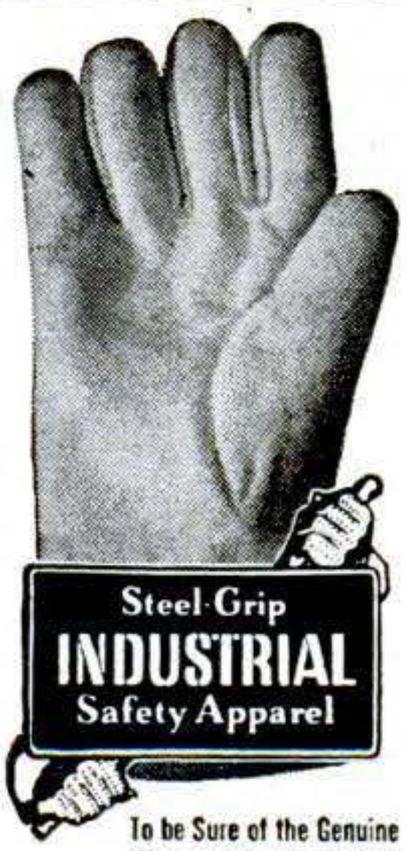

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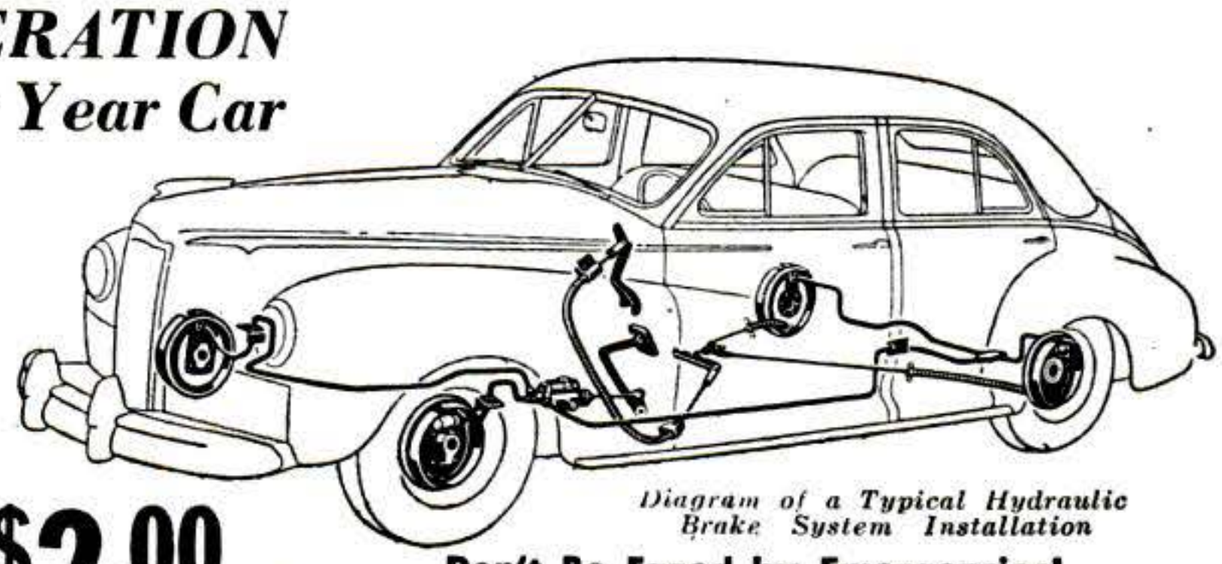

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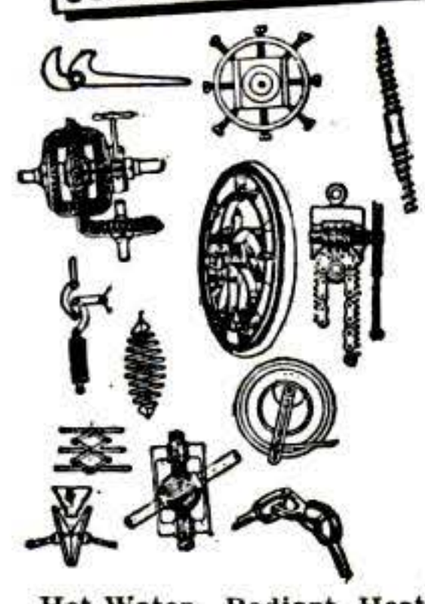

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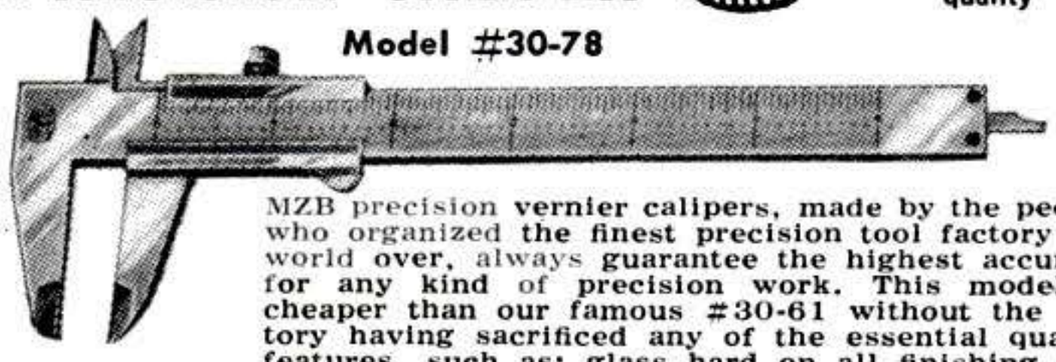

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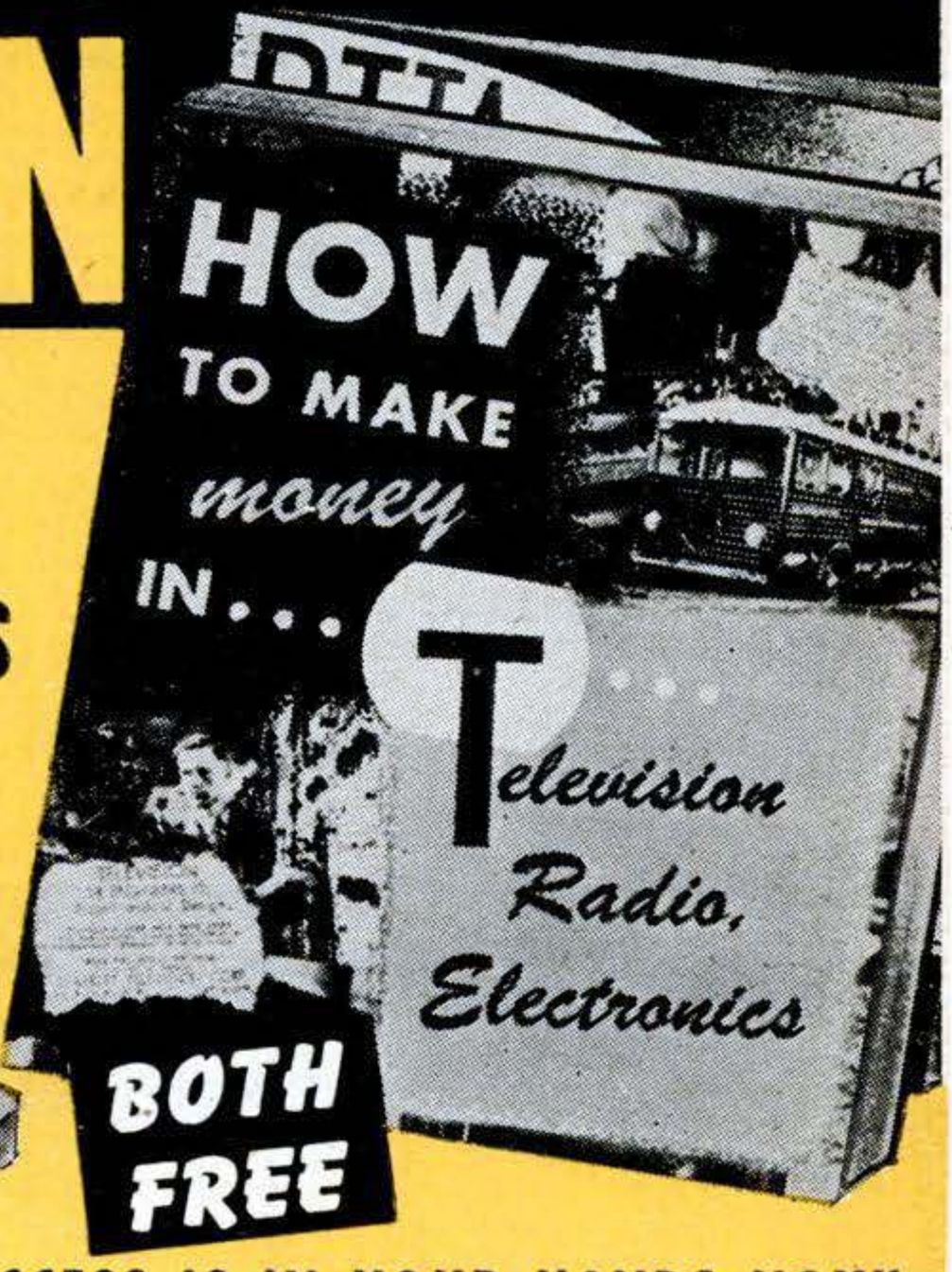

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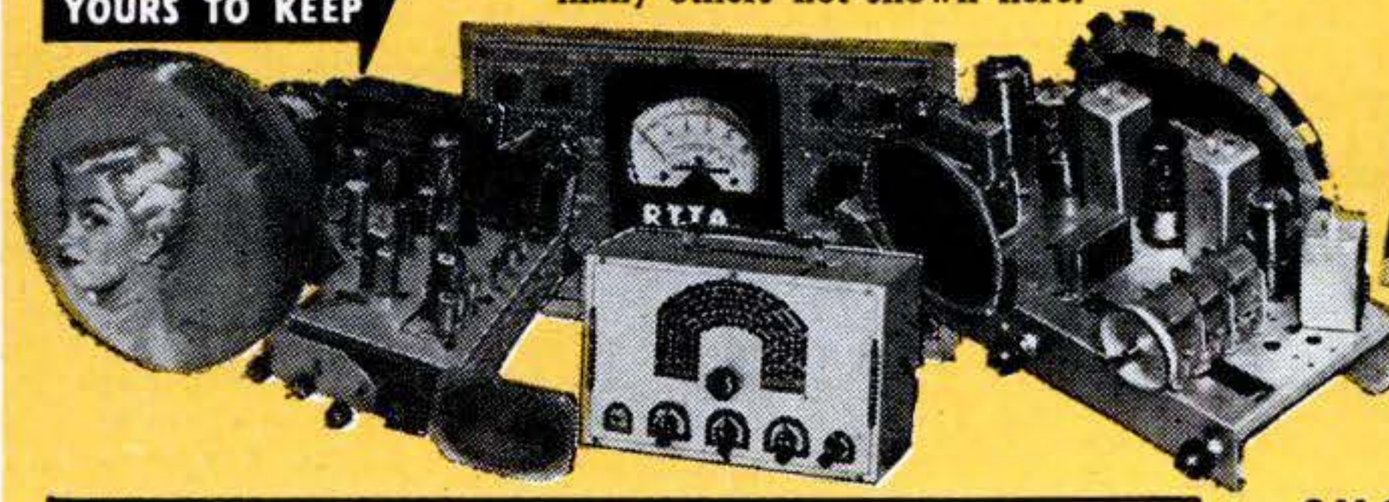

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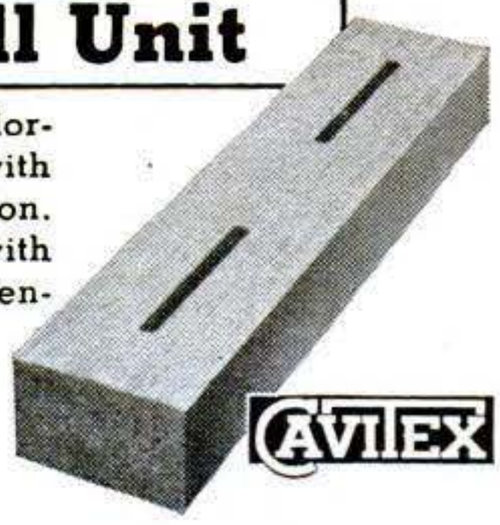

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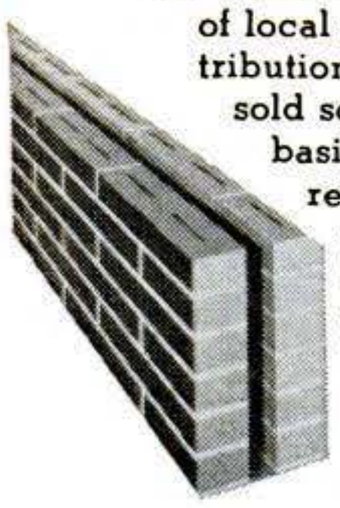

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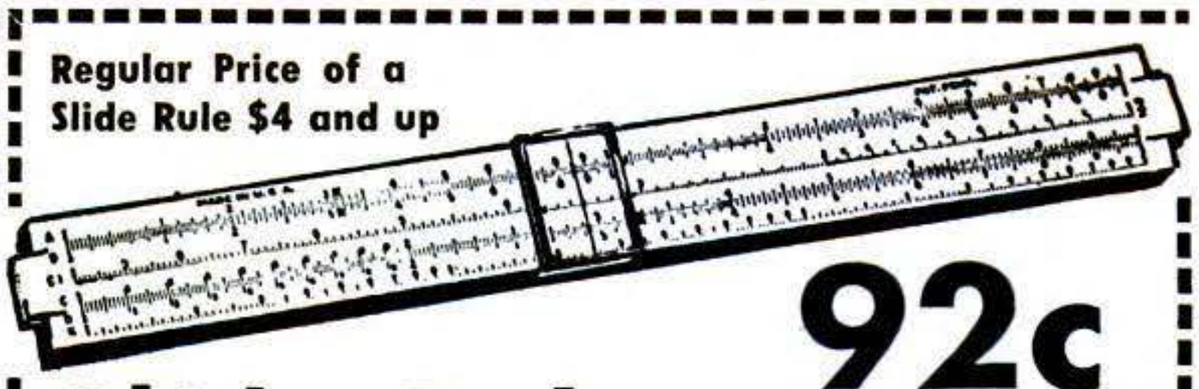

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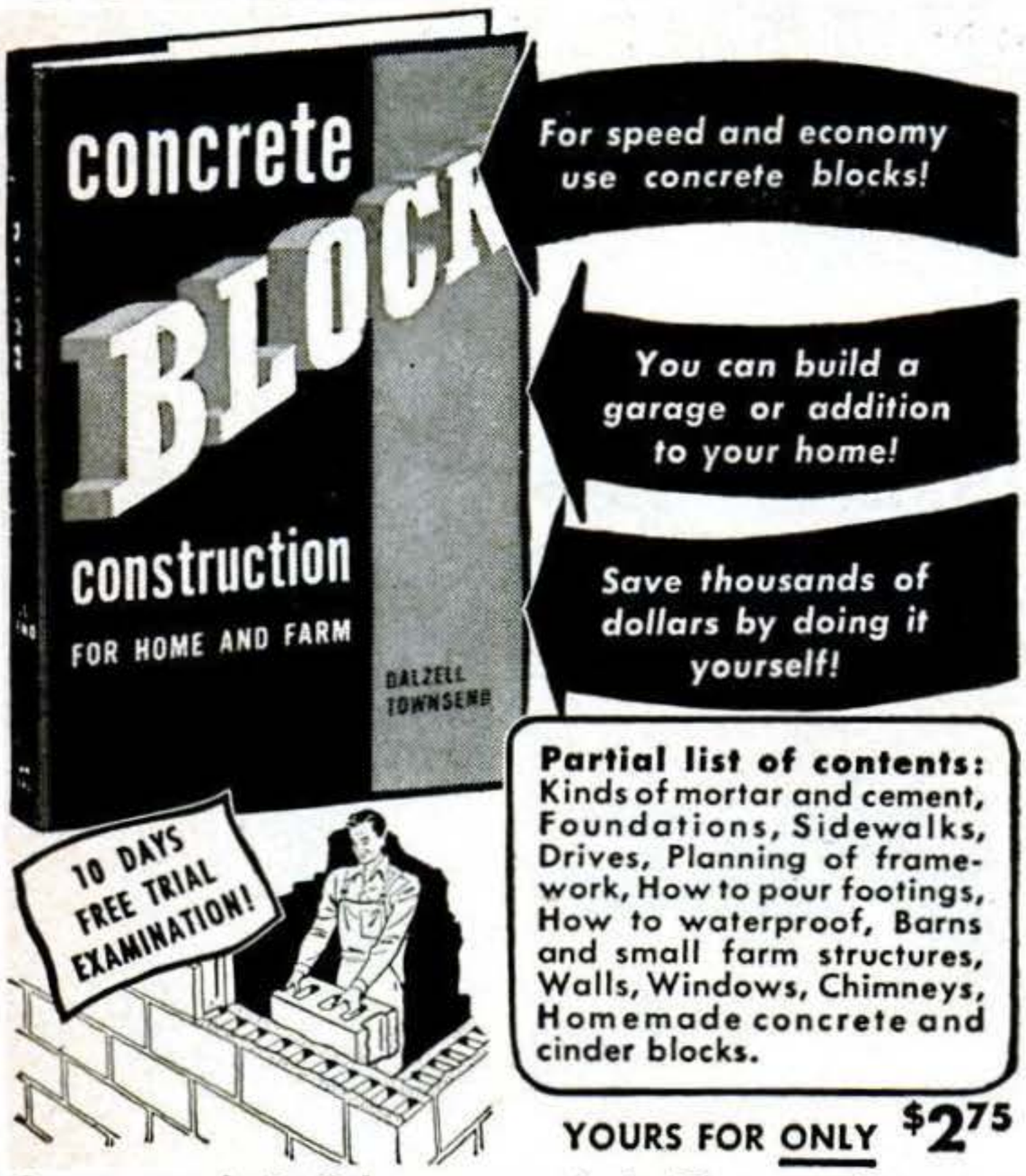

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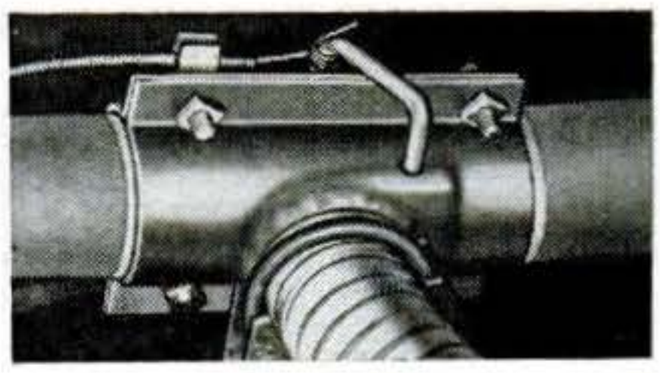

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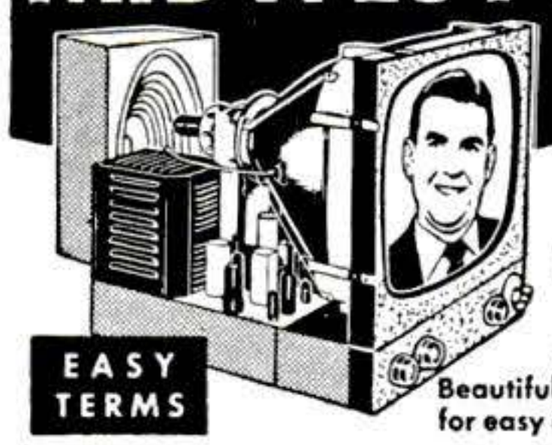

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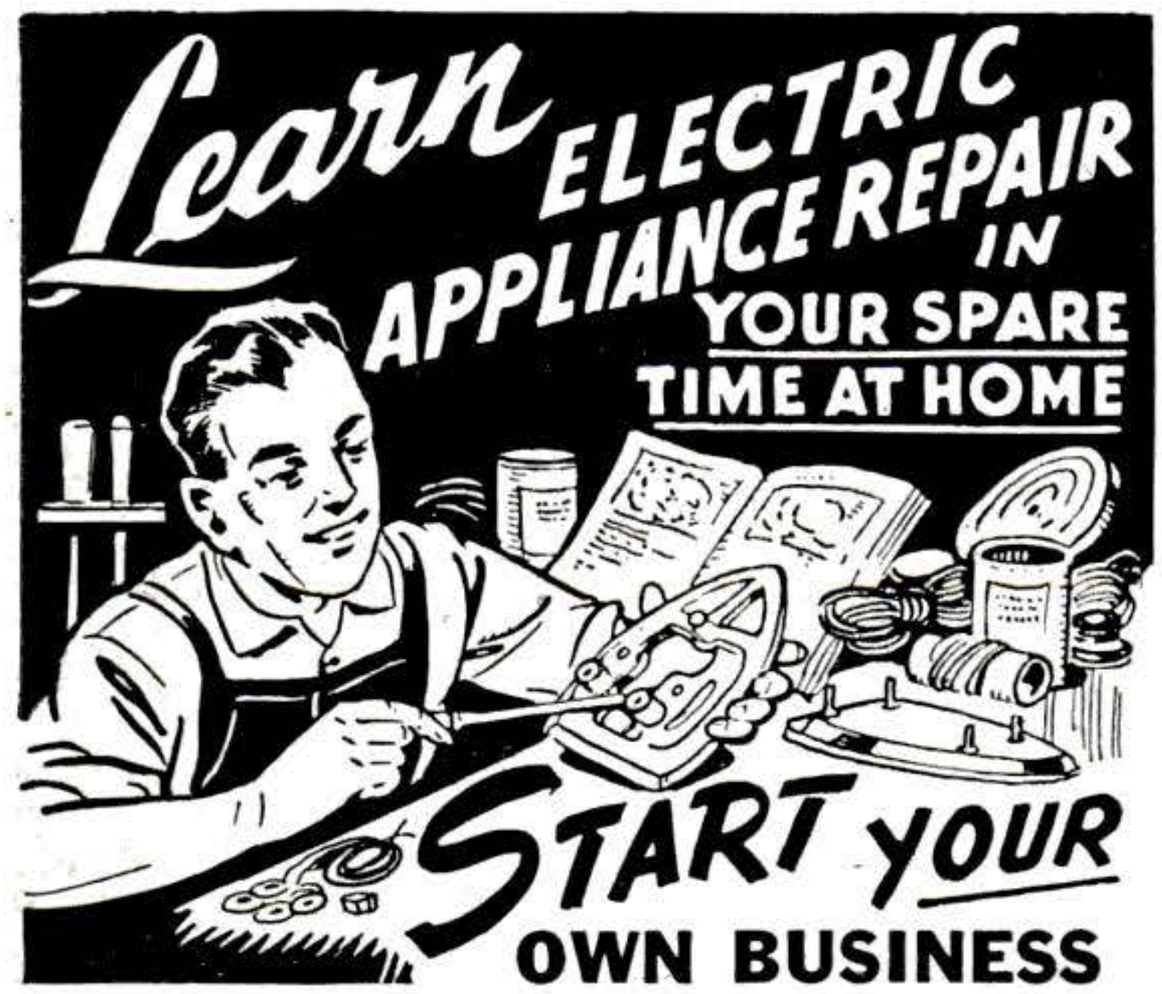

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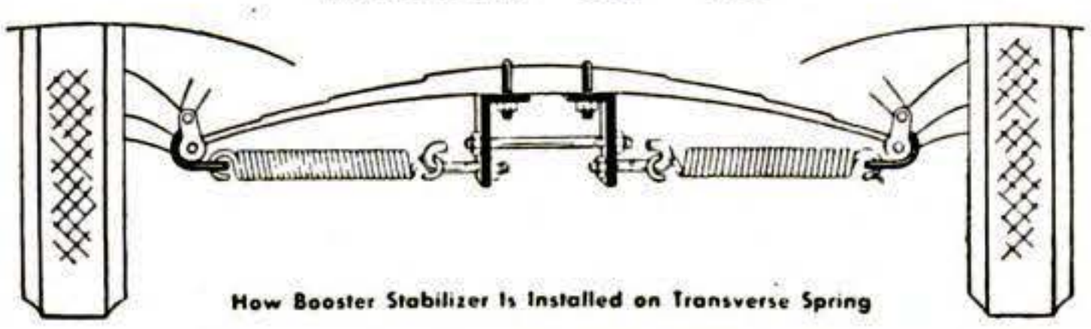

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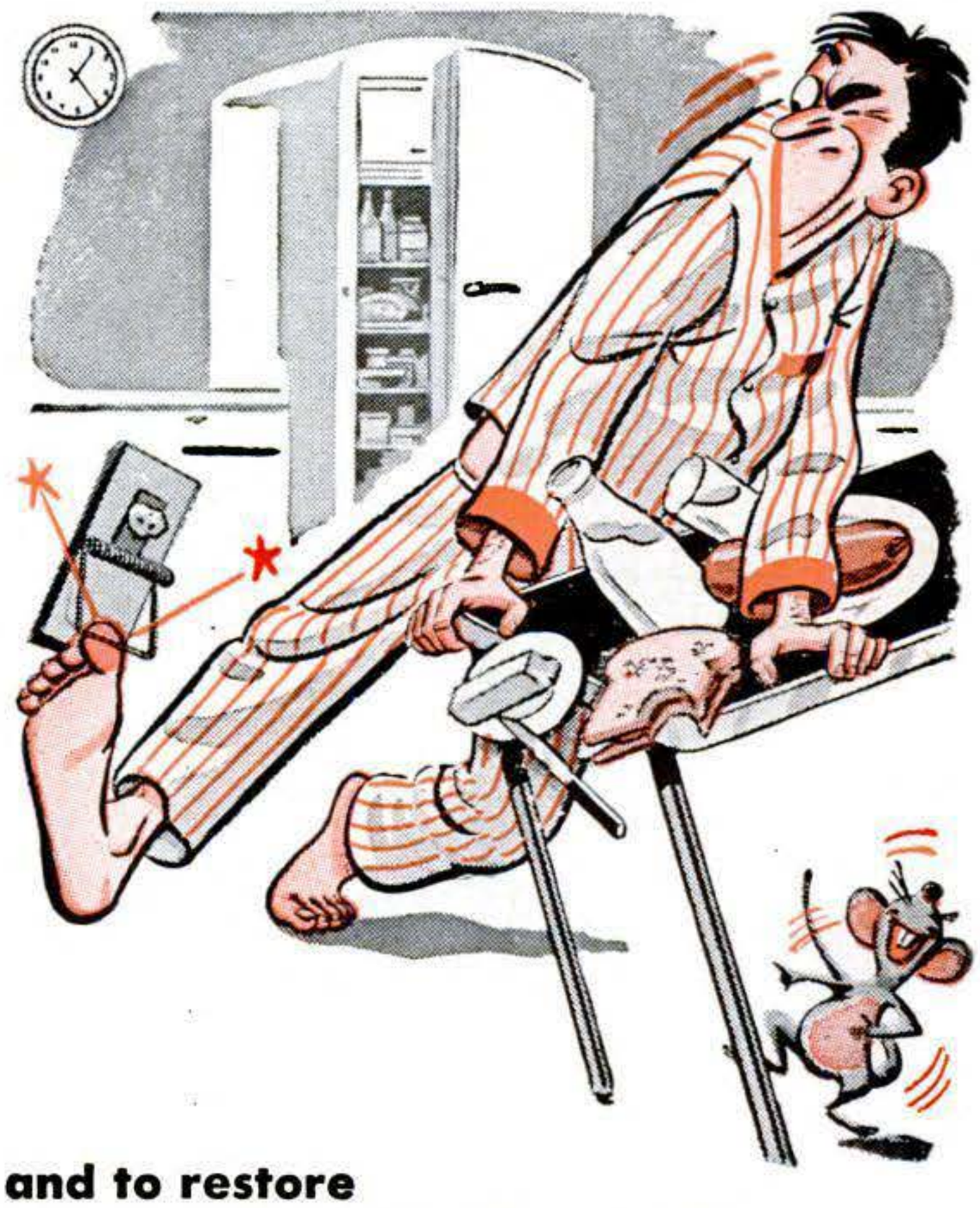

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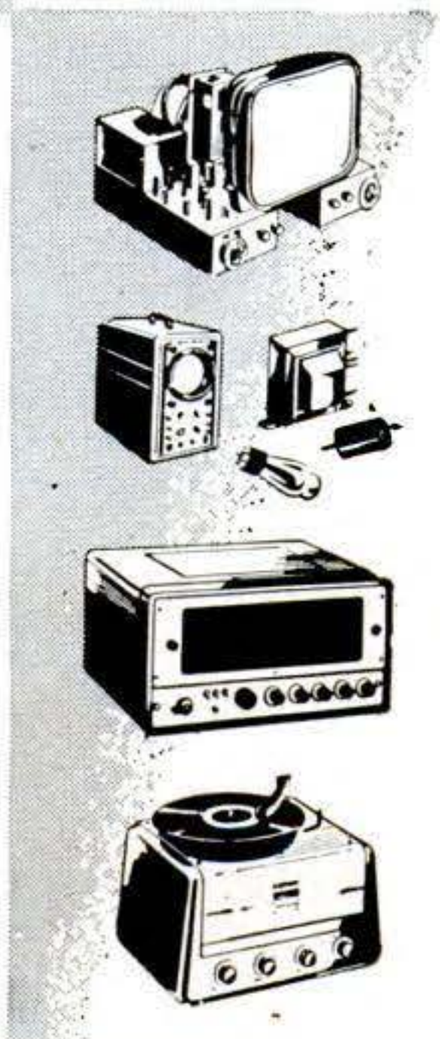

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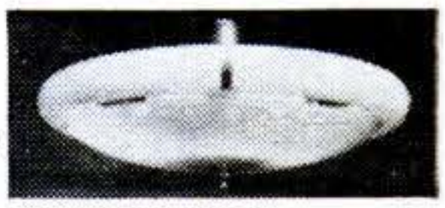

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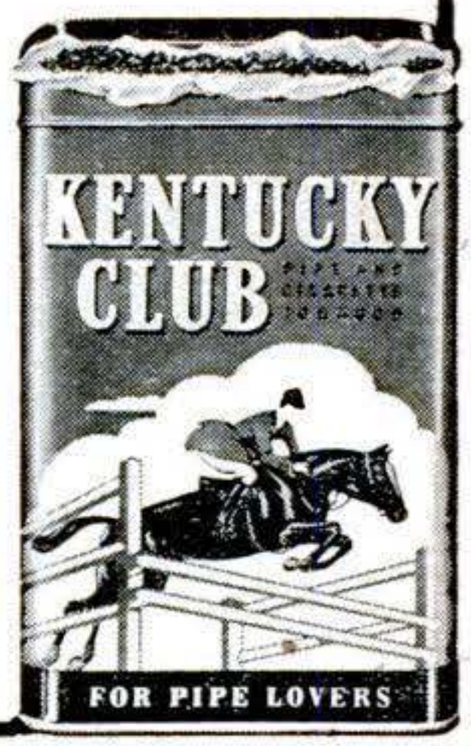

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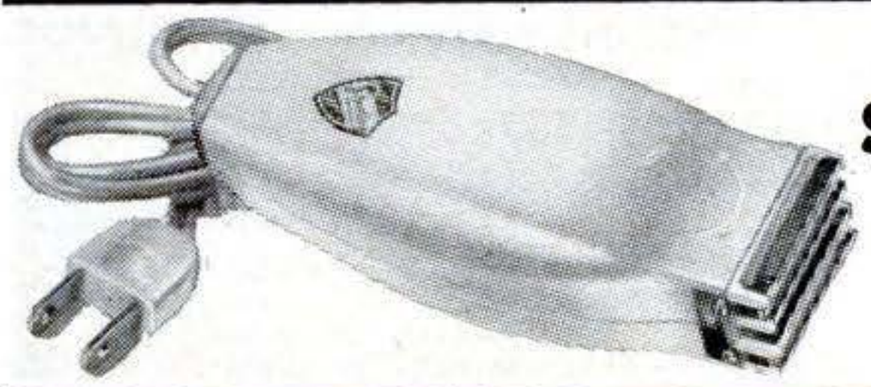

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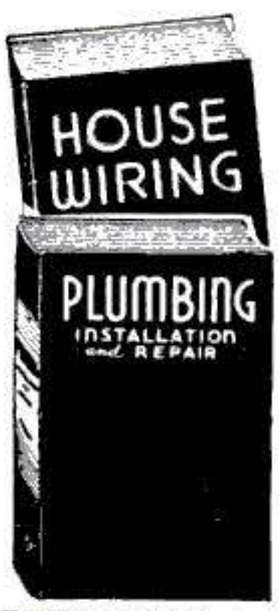

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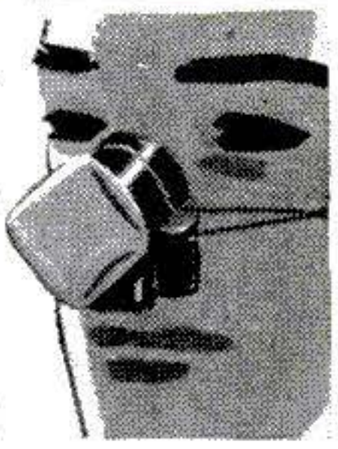

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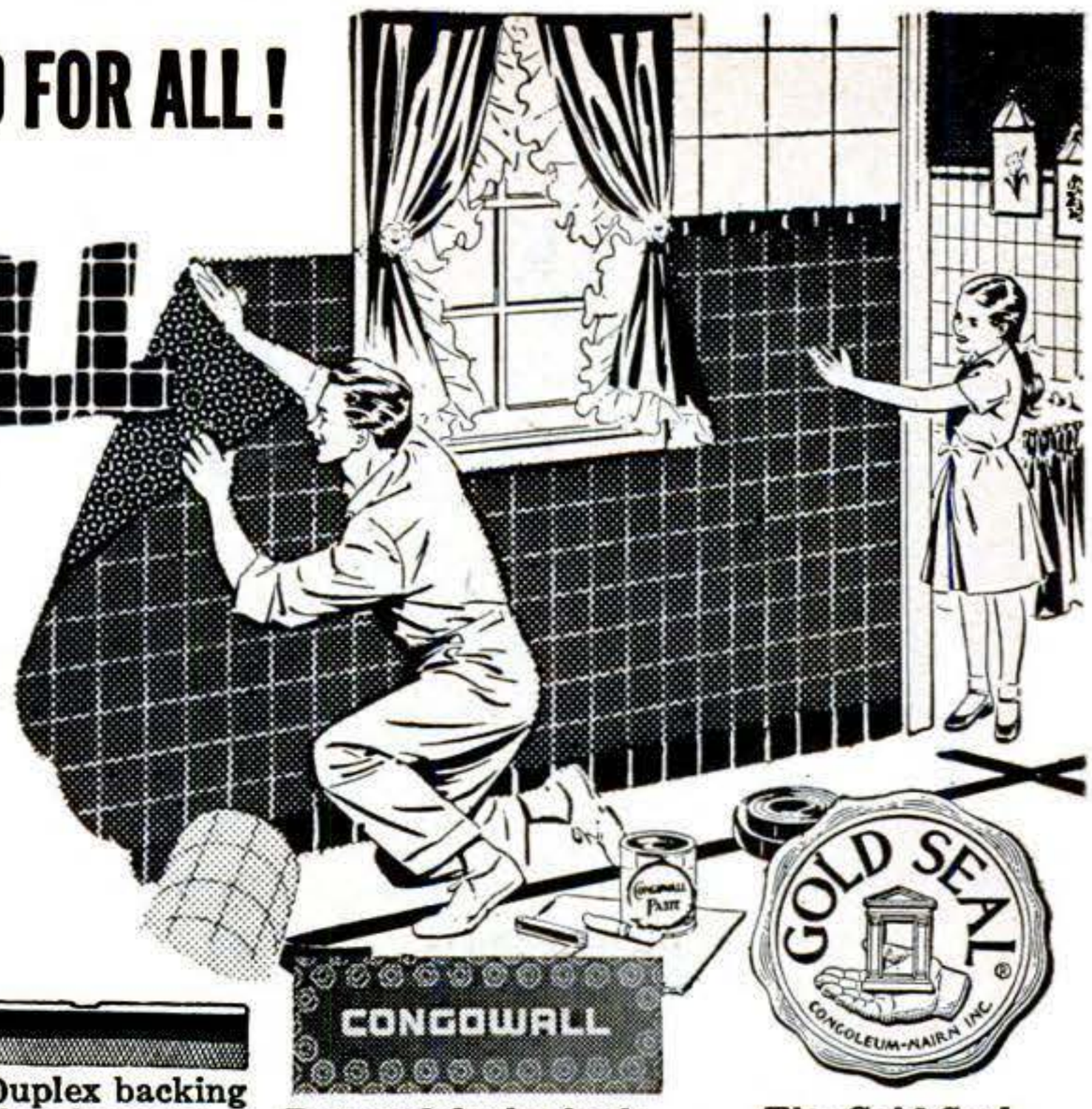

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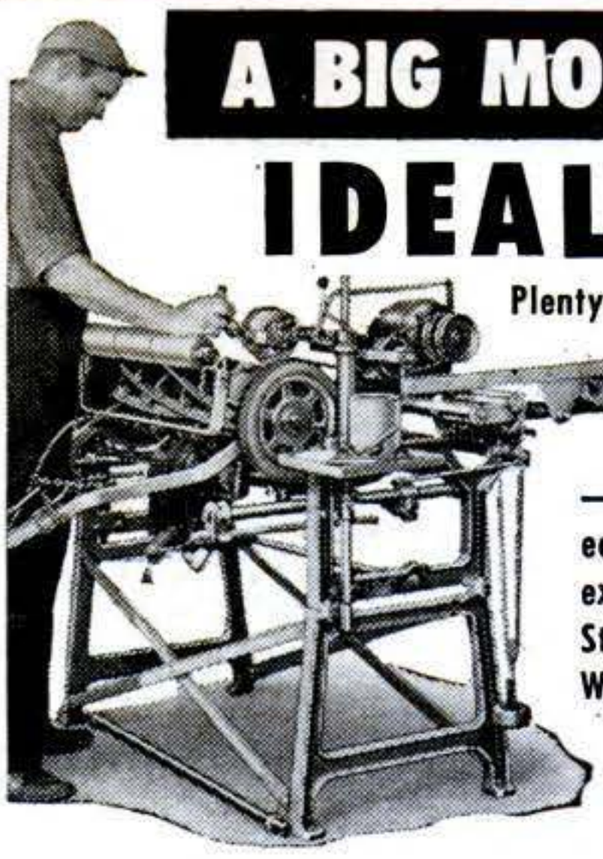

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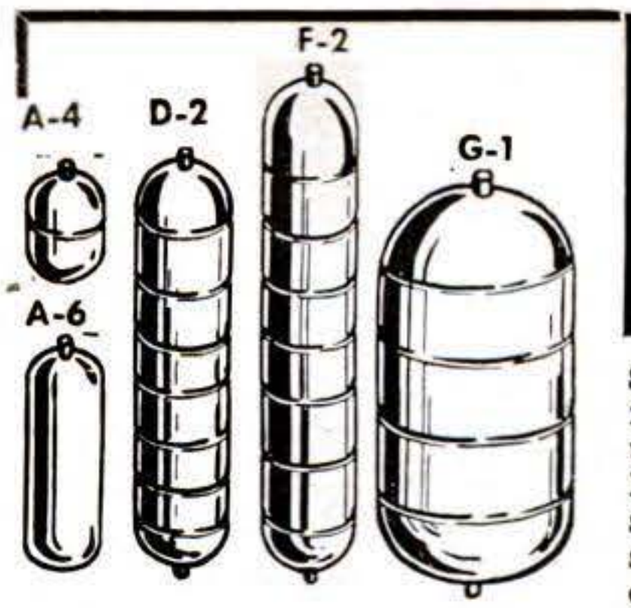

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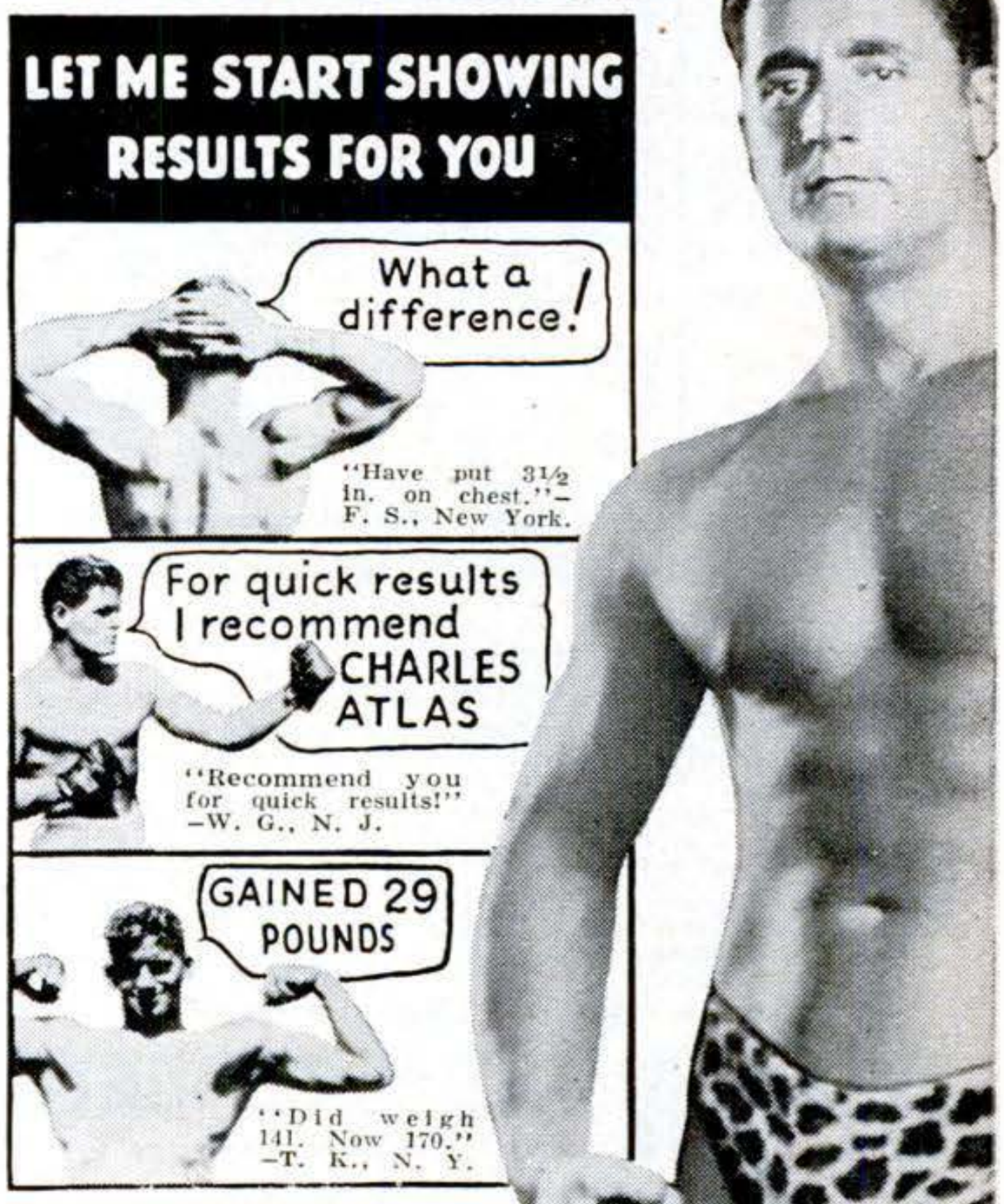

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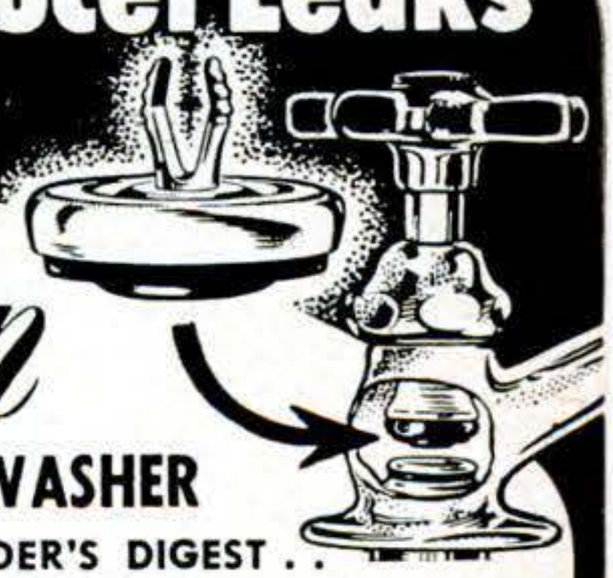

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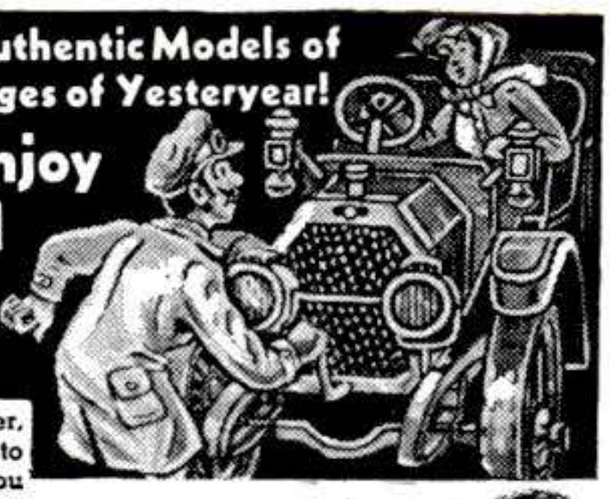

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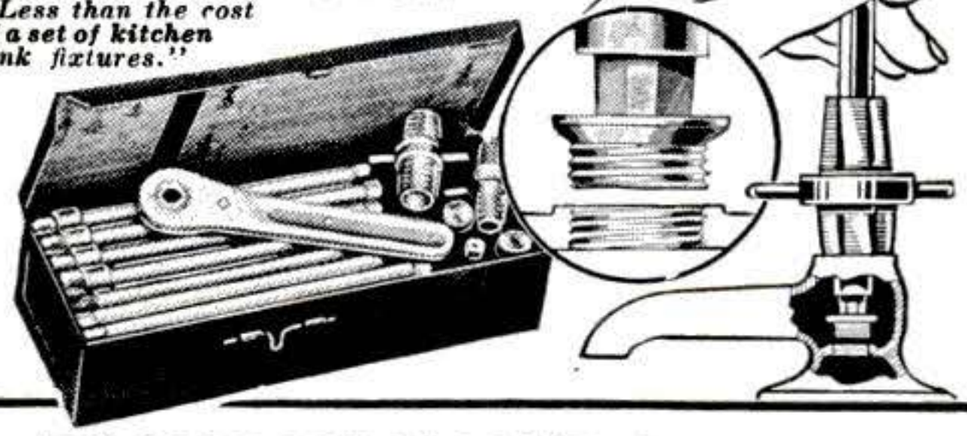

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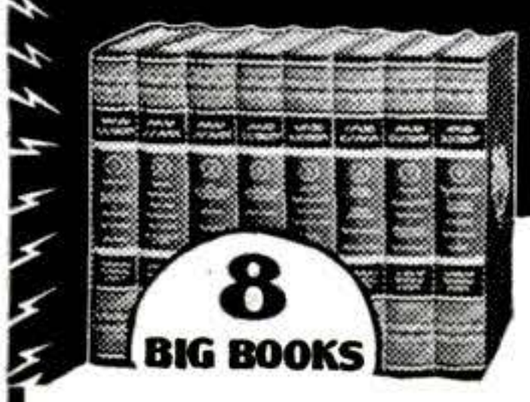

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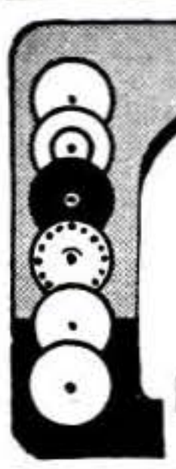

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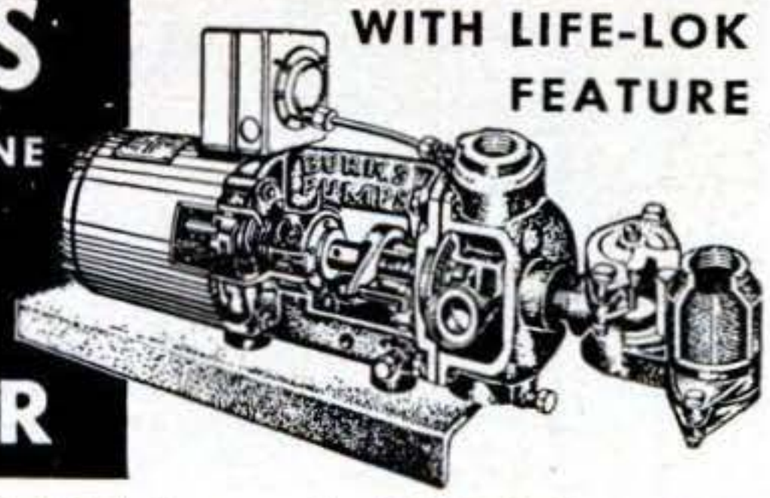

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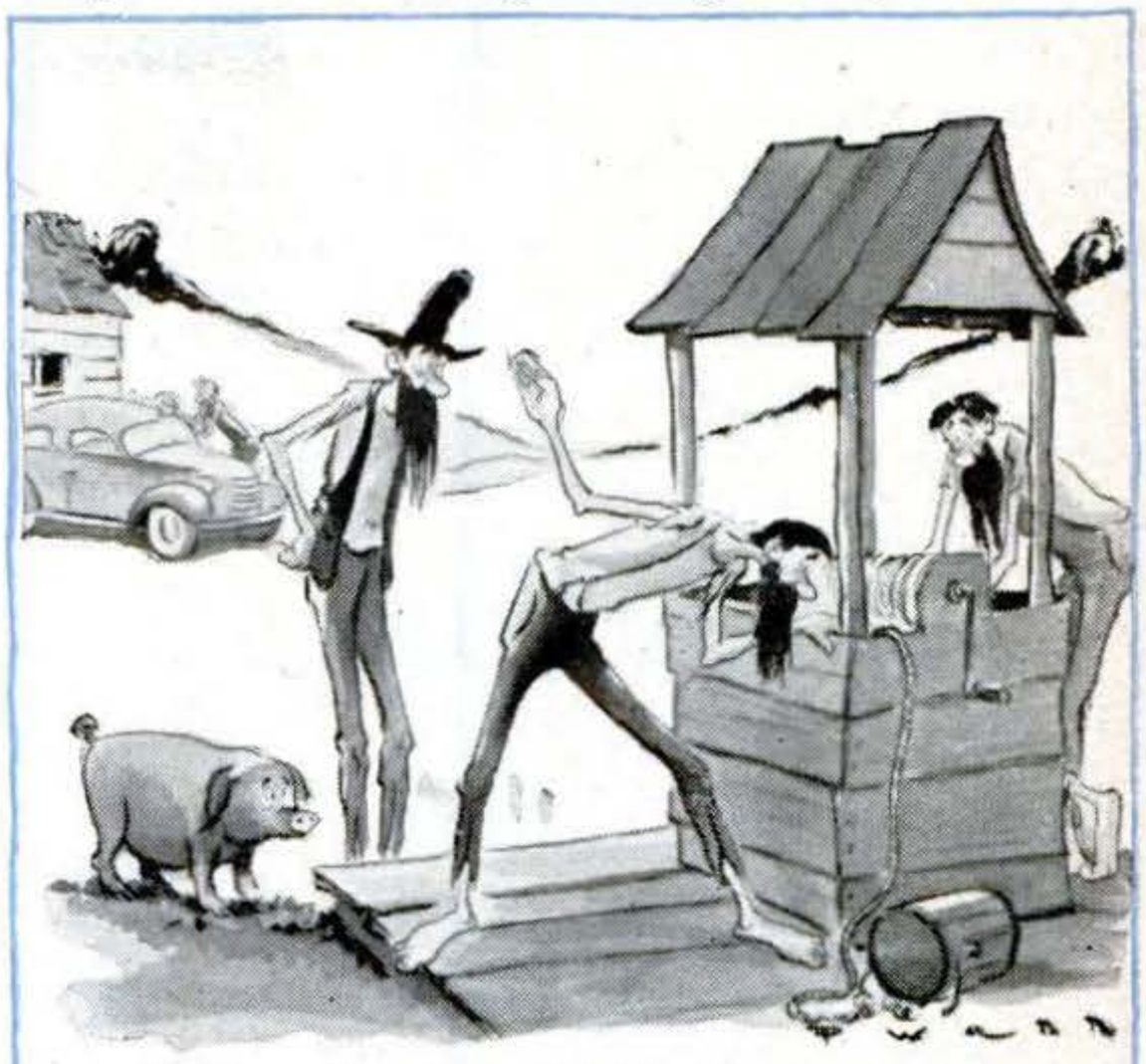

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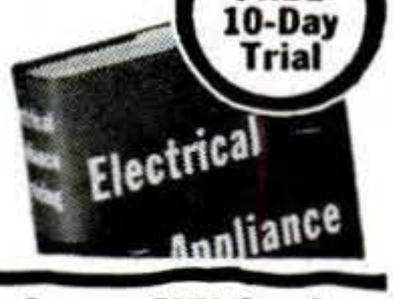

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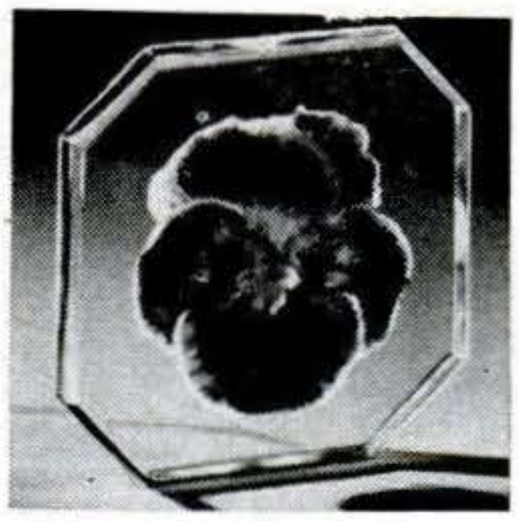

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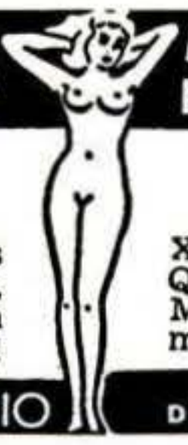

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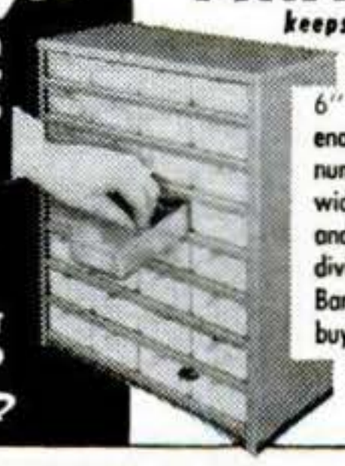

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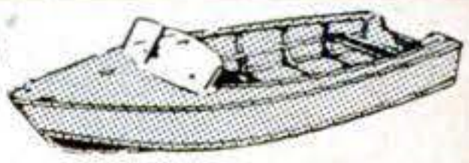

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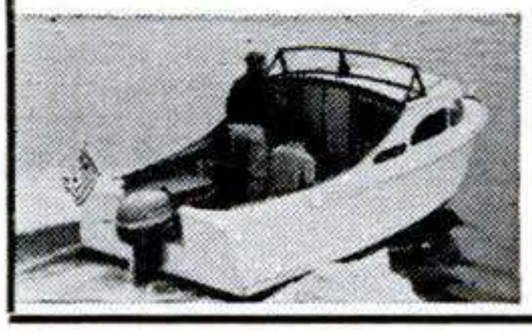

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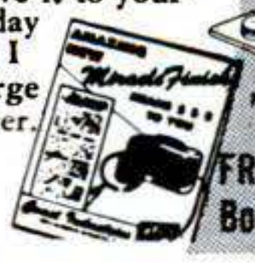

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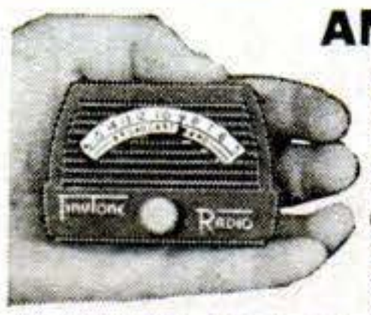

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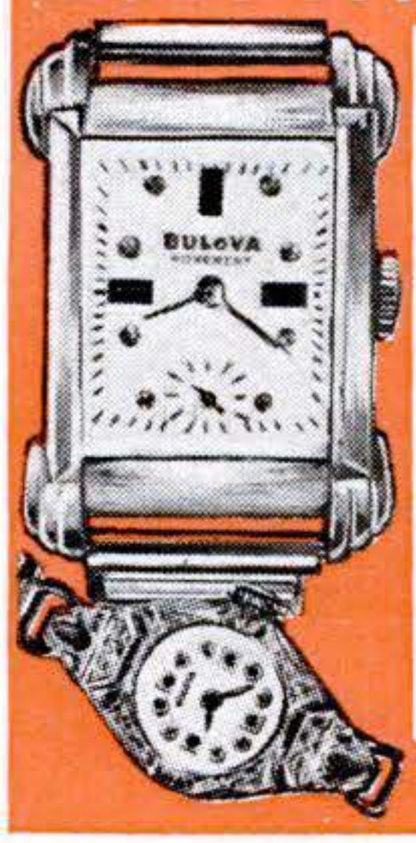

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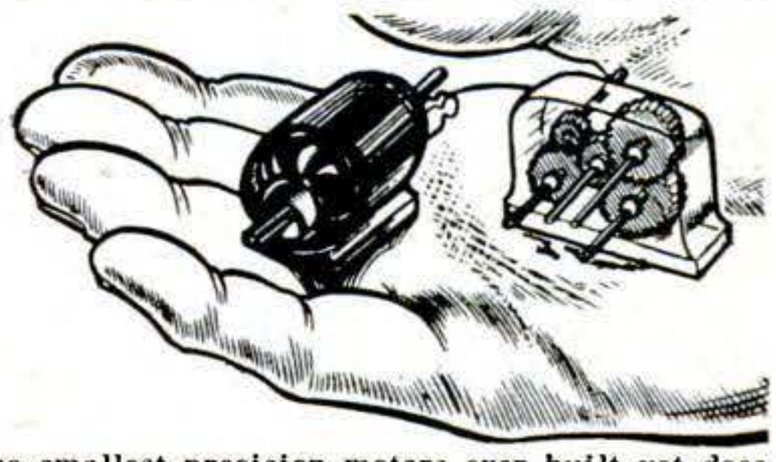

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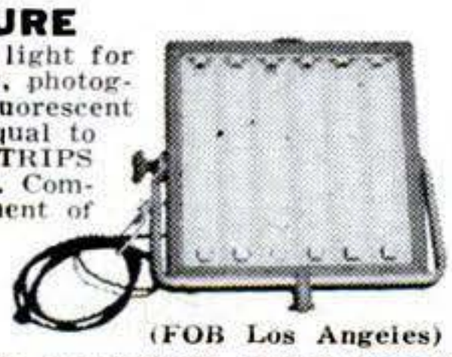

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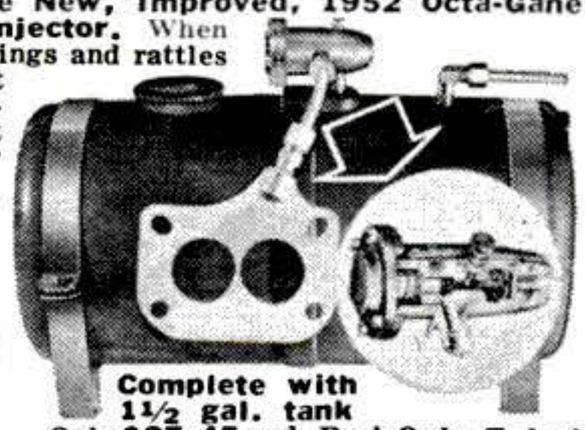

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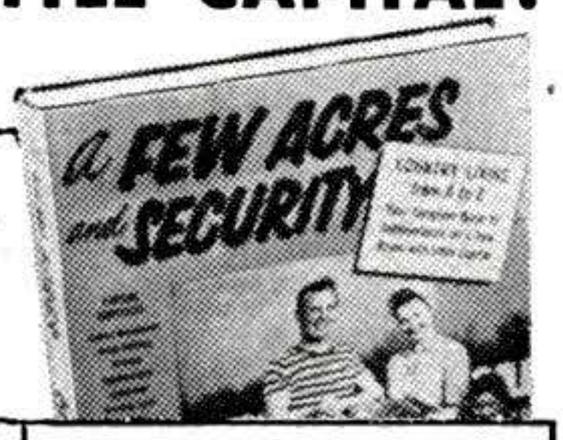

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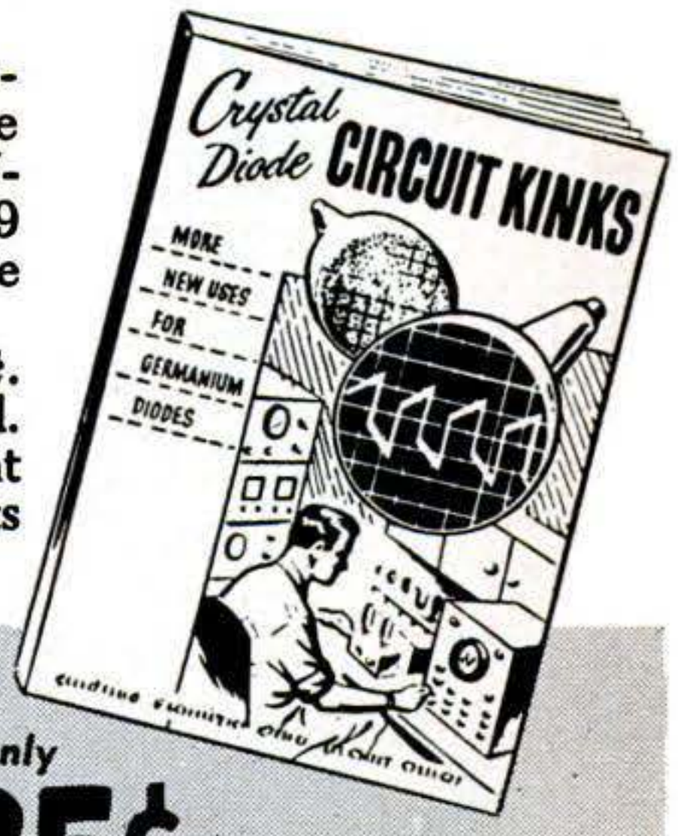

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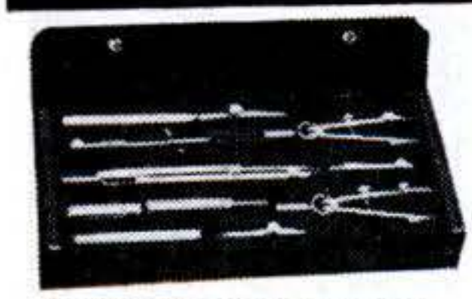

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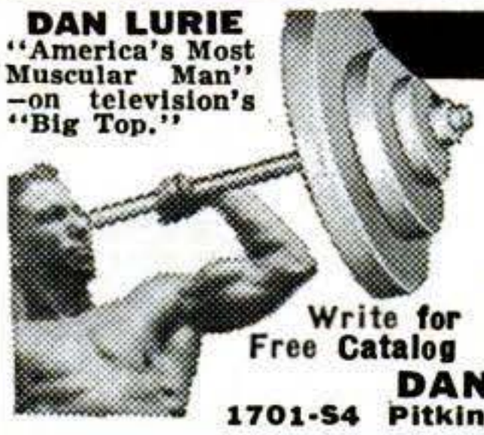

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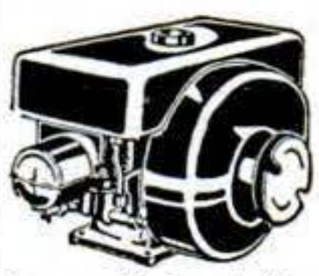

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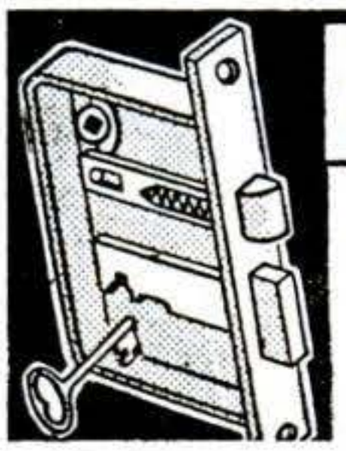

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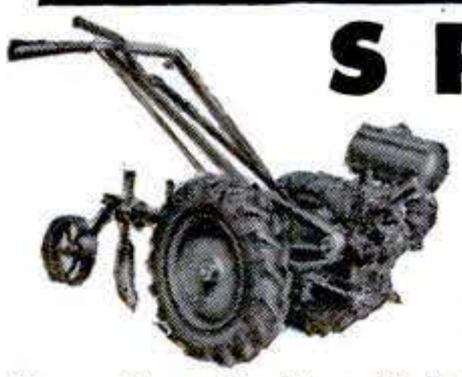

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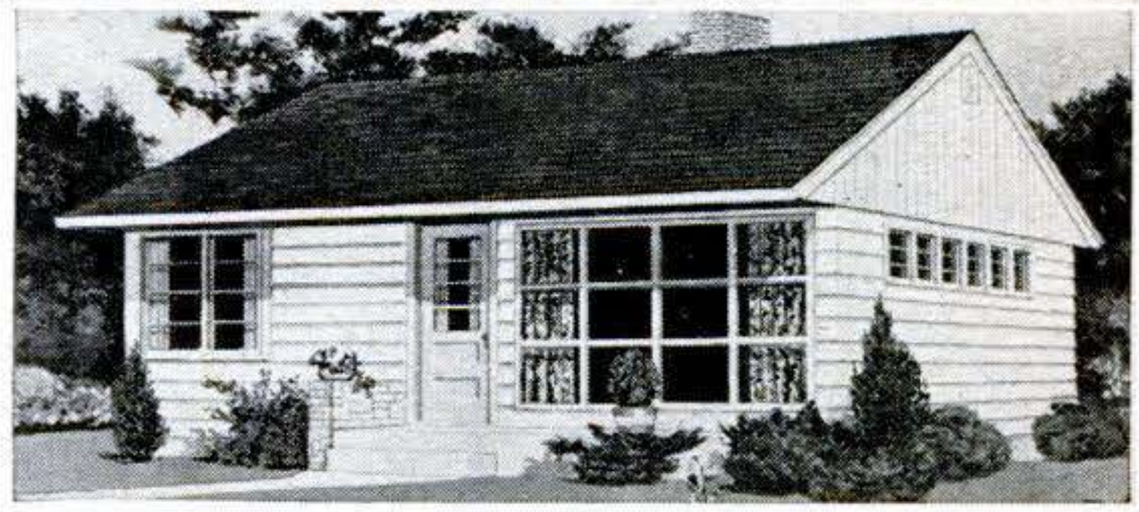

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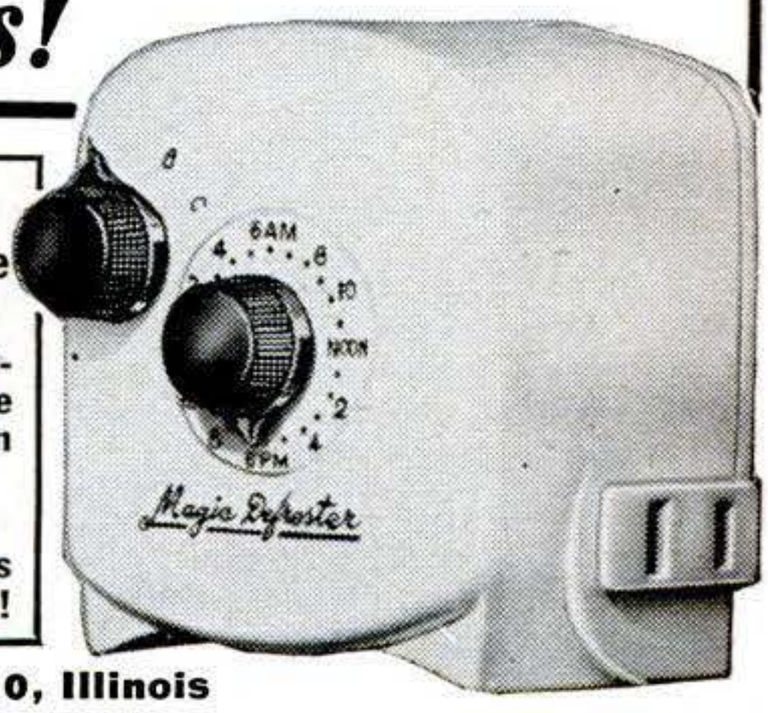

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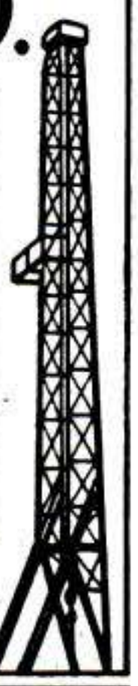

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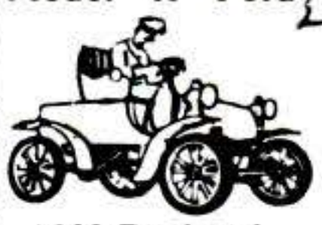

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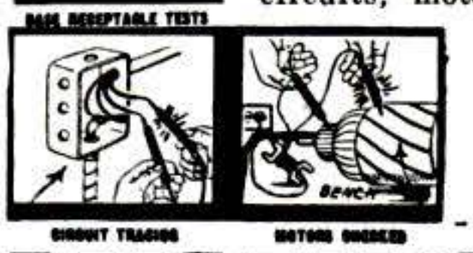

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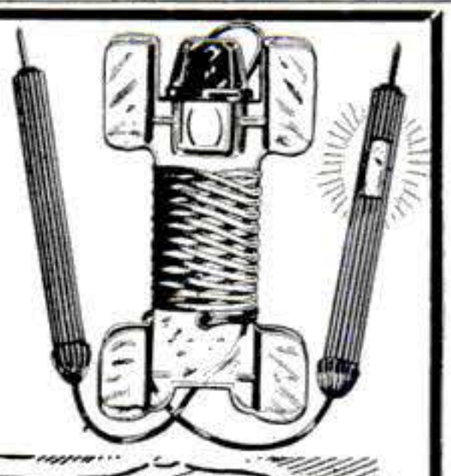

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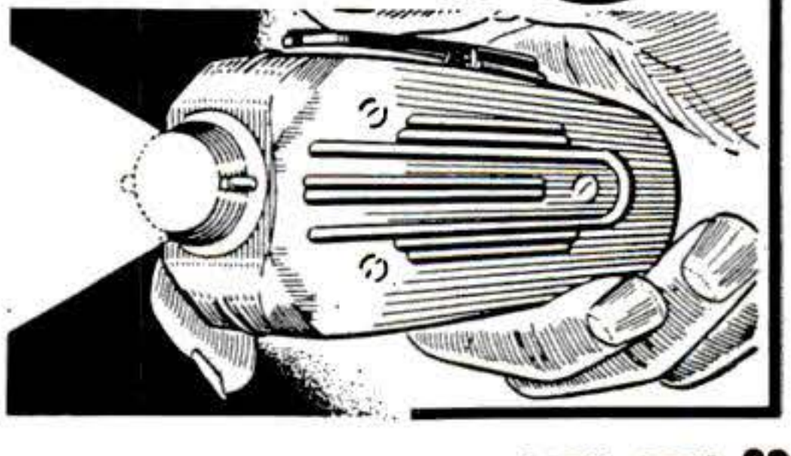

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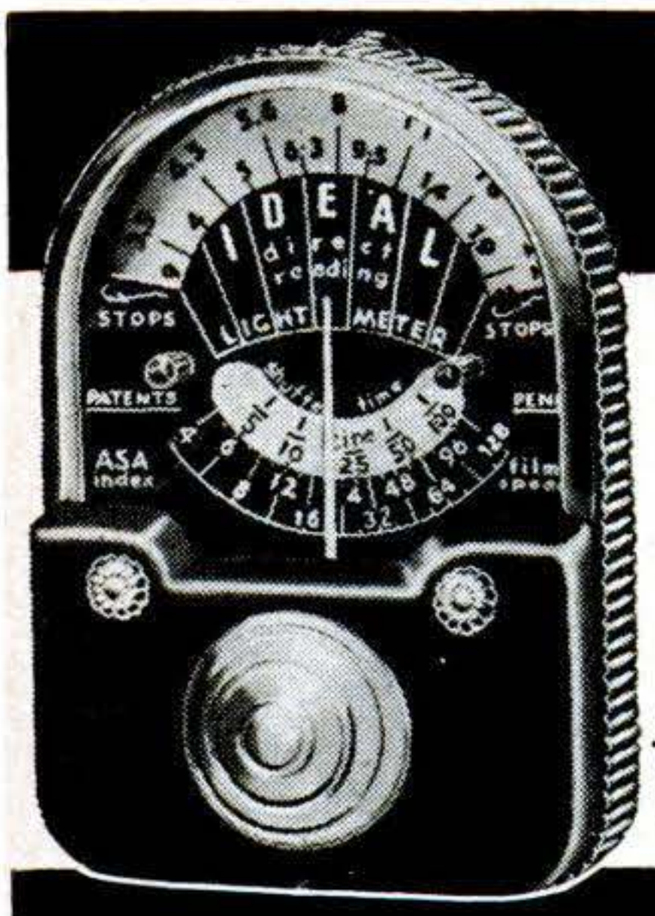

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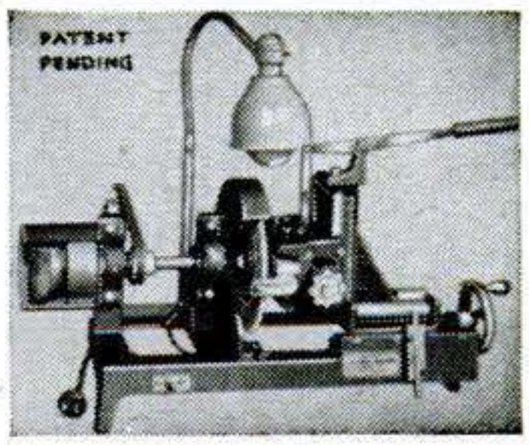

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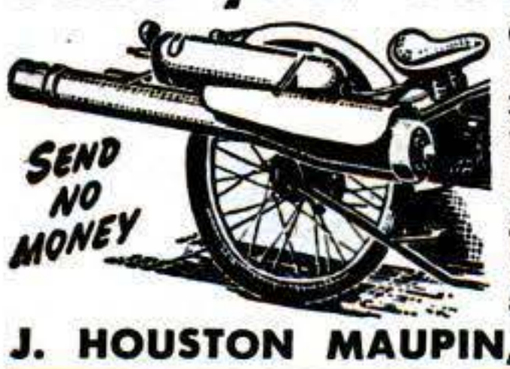

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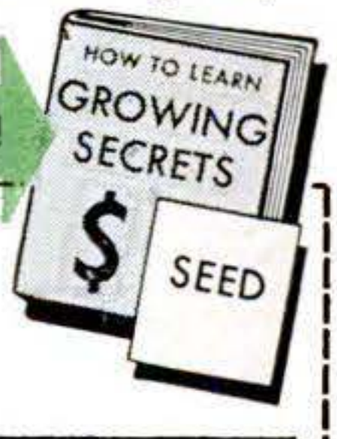

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FOREIGN & Latin American Employment 1952 "Foreign Service Directory" gives Up-To-Minute Facts on Military & Civilian Construction, Government Jobs, Major Oil Listings, Aviation, Transportation, Steamship Lines; Mining, Importers, Exporters, How-When-Where to apply, application forms, Hot List Firms Hiring. $1.00 post-paid. Global Reports, P.O. Box 883-S, Hollywood 28, Calif

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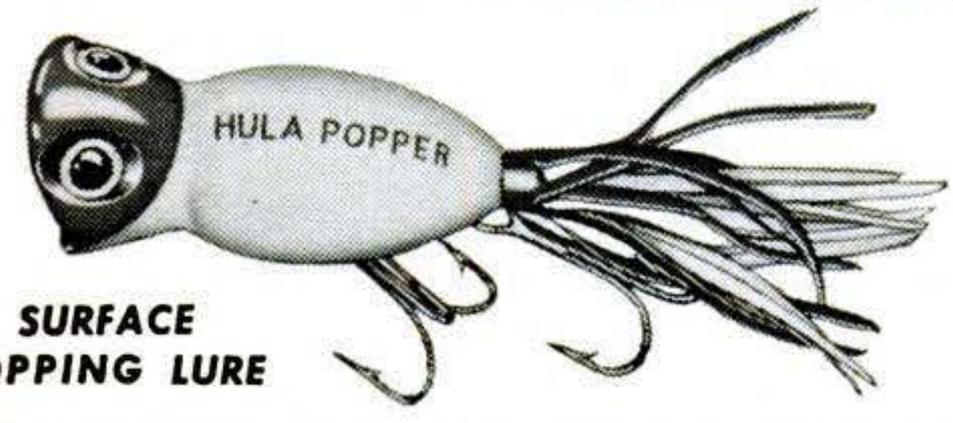

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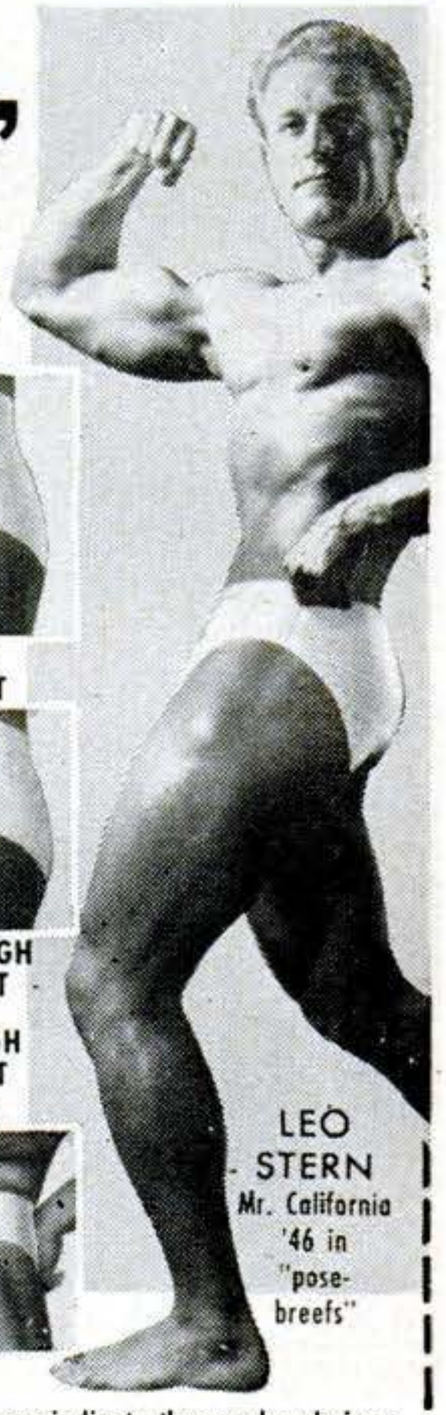

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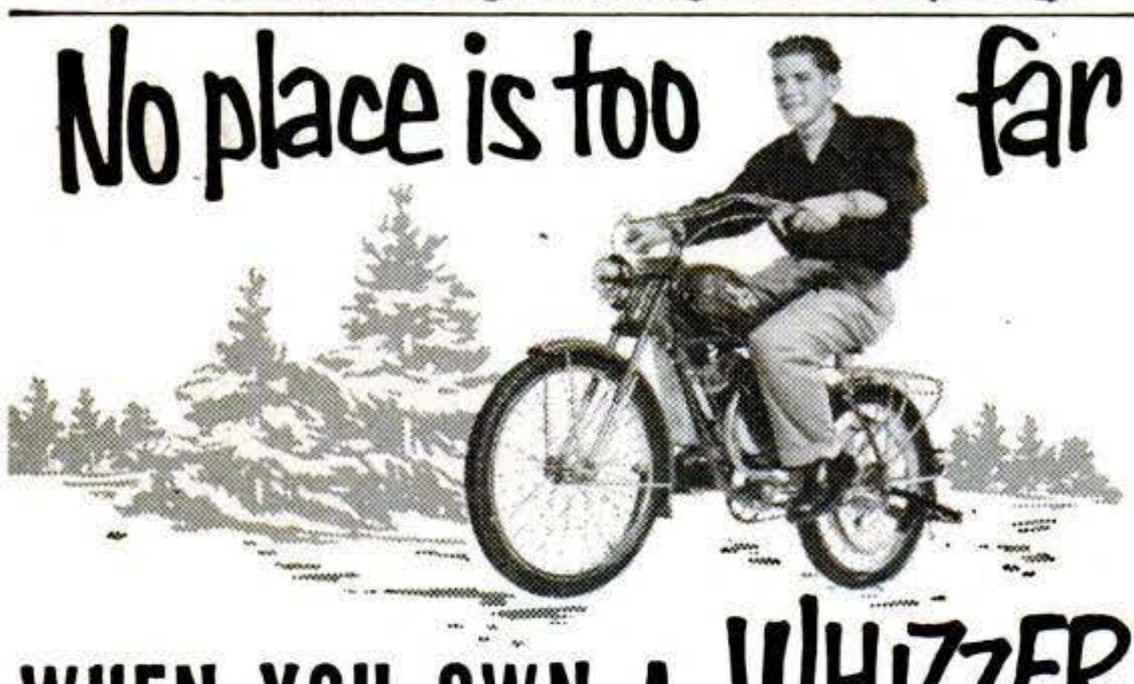

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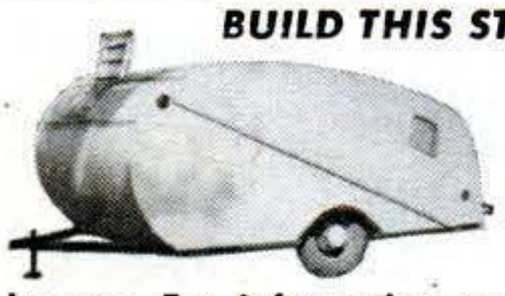

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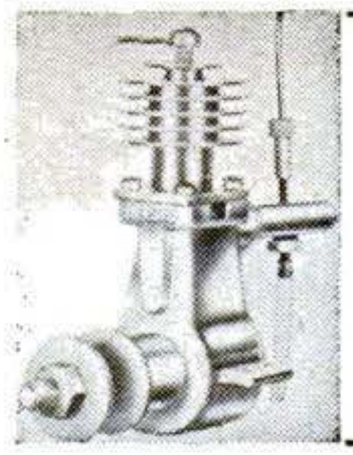

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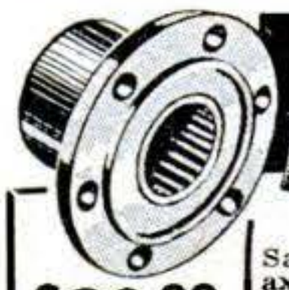

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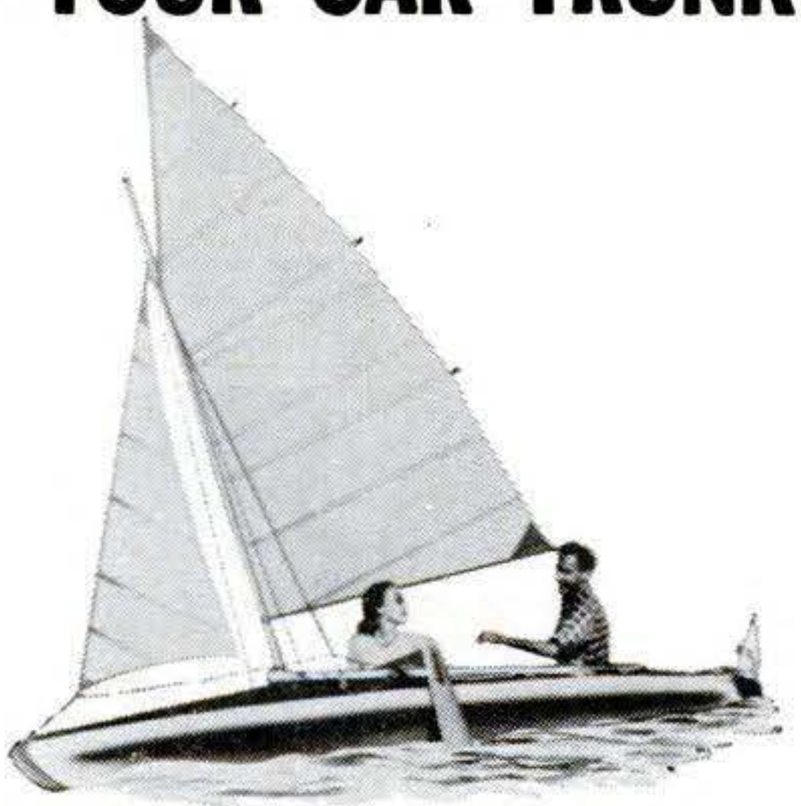

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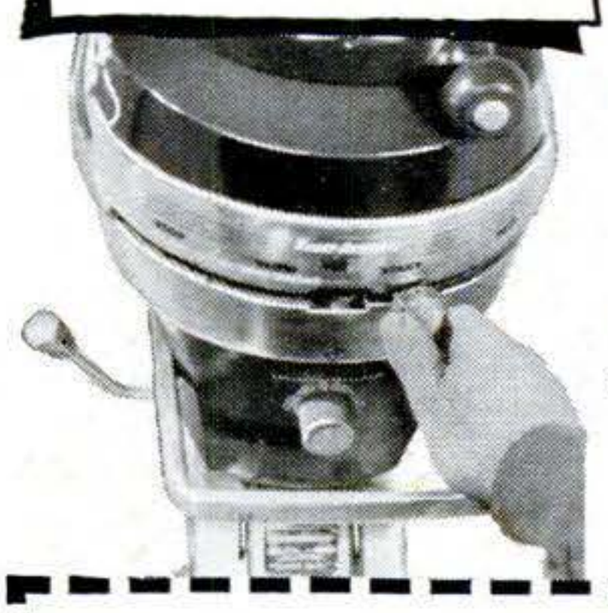

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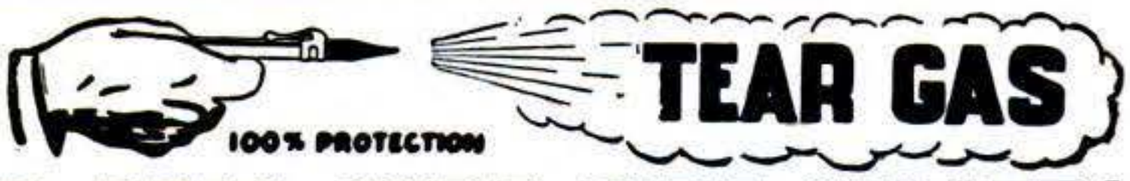

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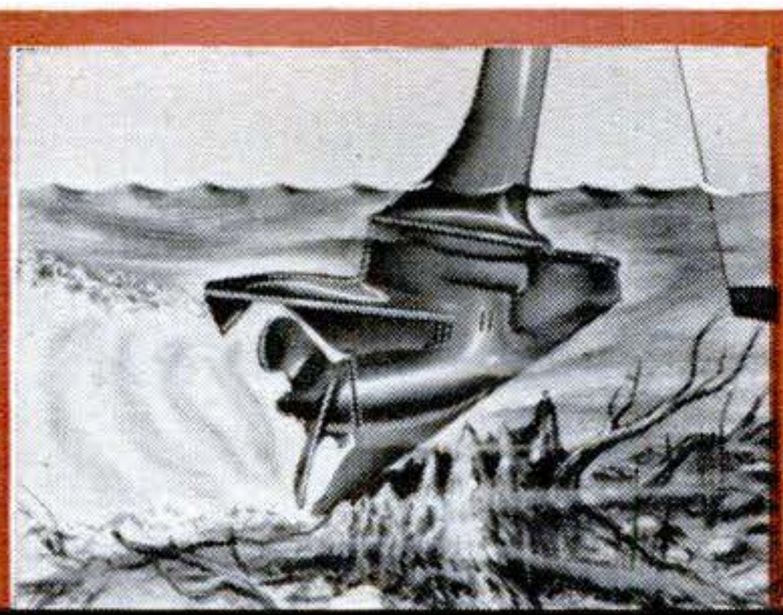
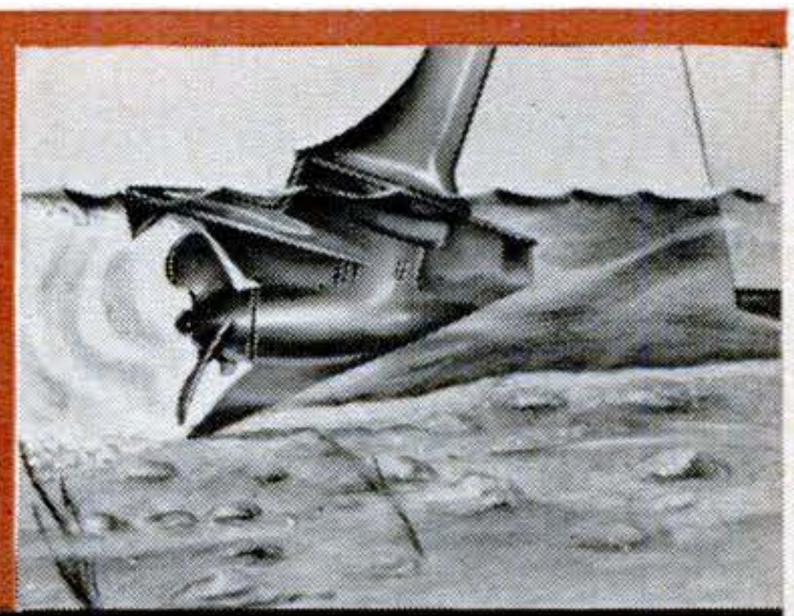


IT SKIS RIGHT OVER UNDERWATER OBSTRUCTIONS



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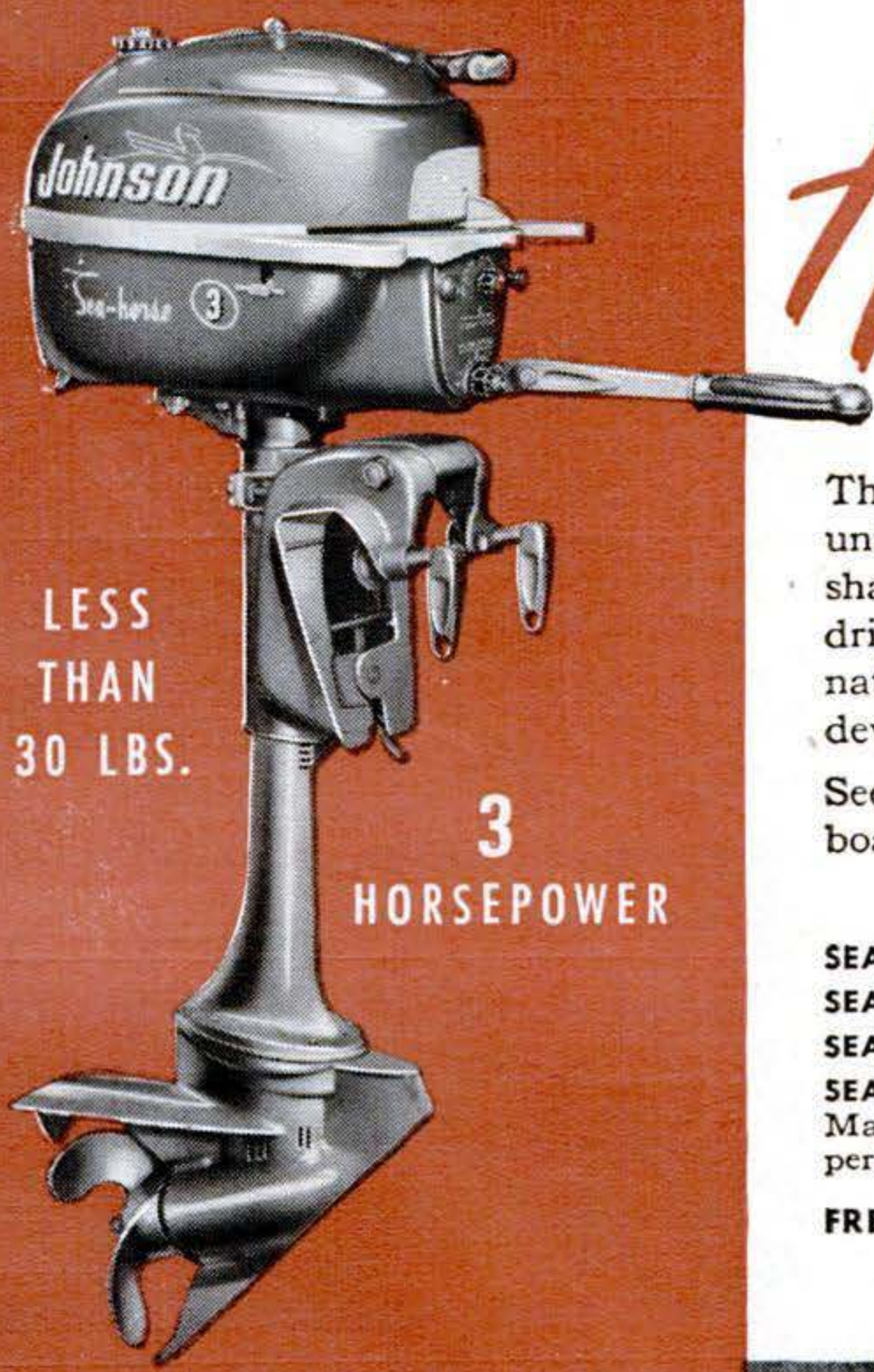

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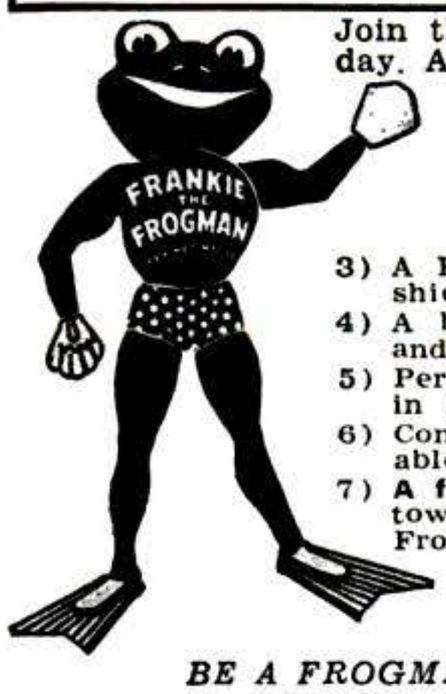

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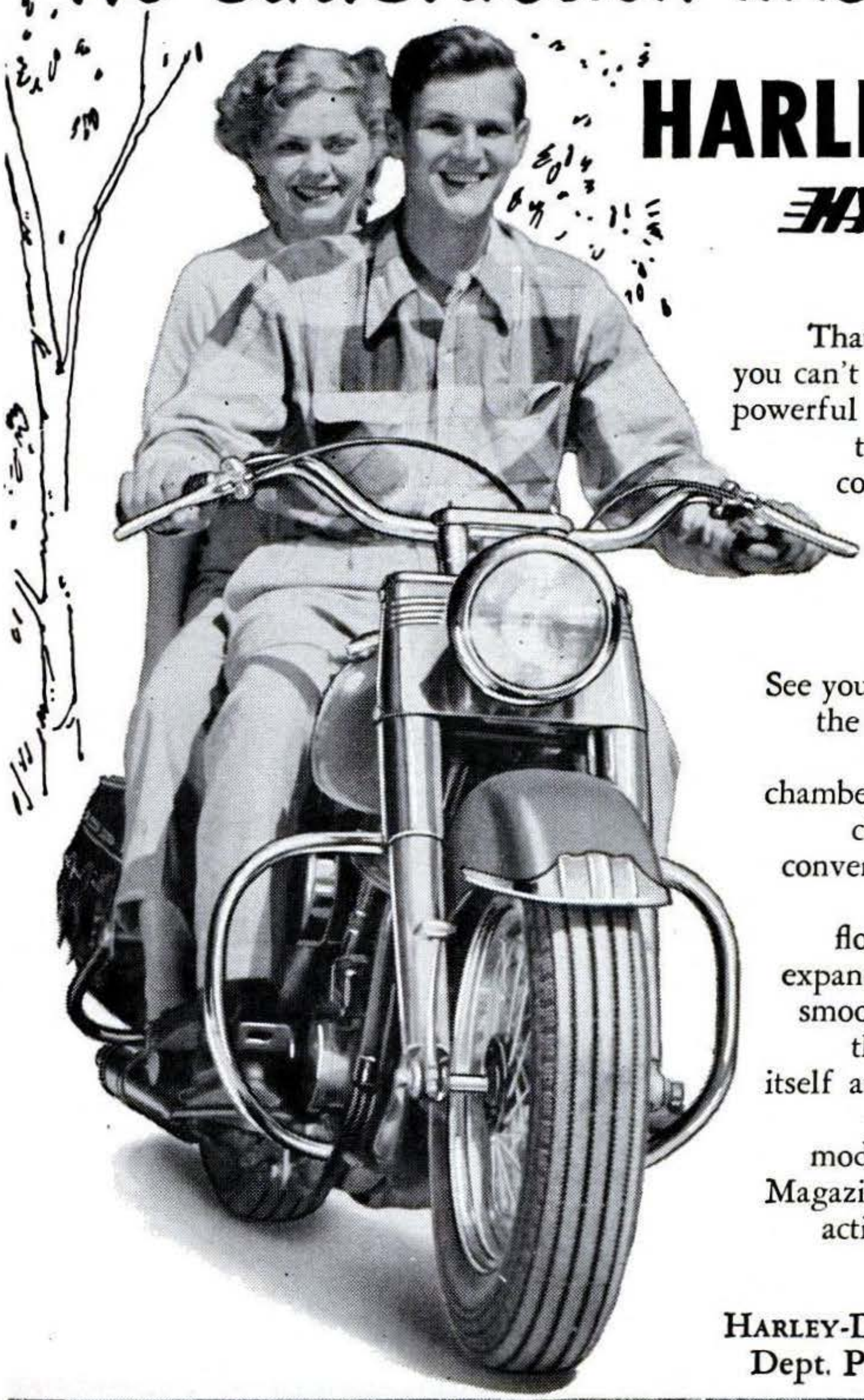

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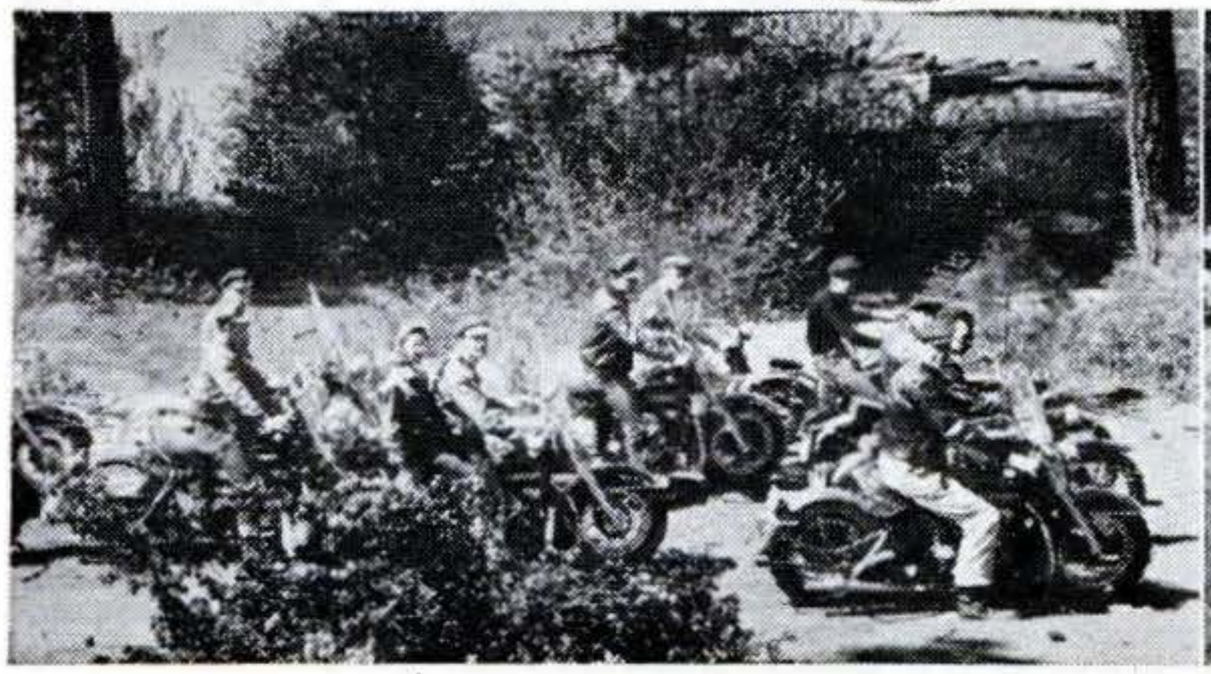

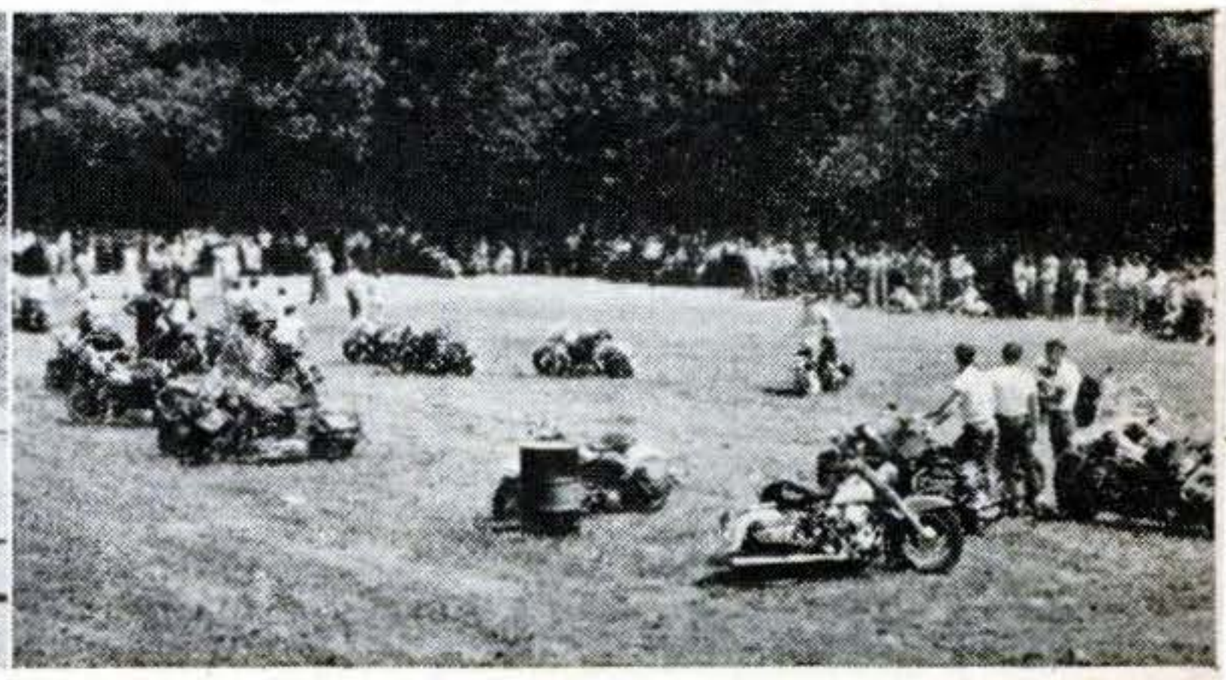

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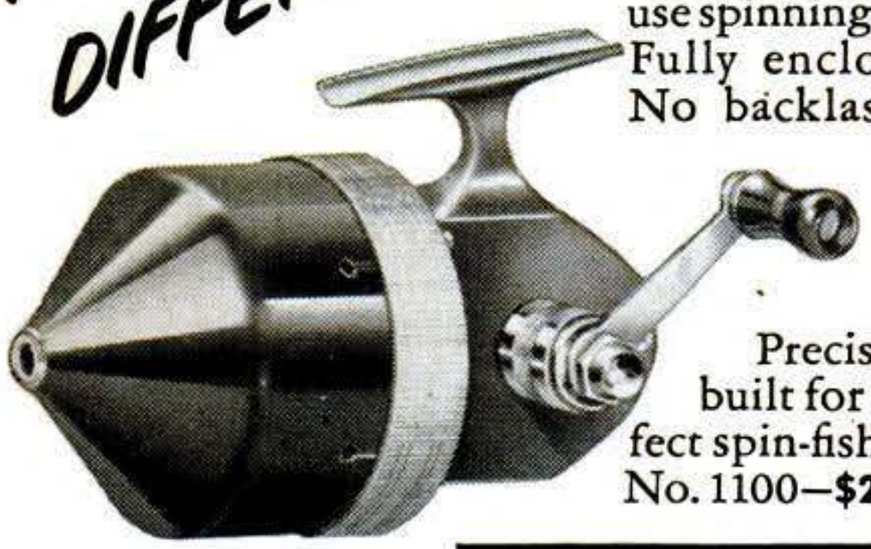

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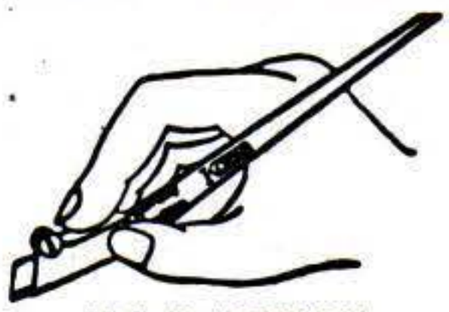

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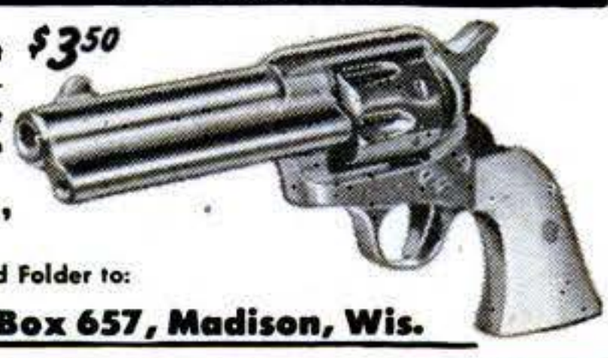

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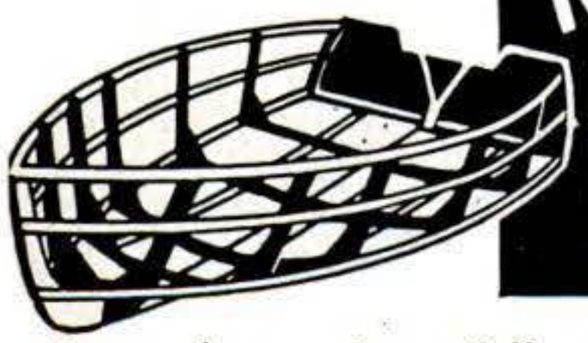

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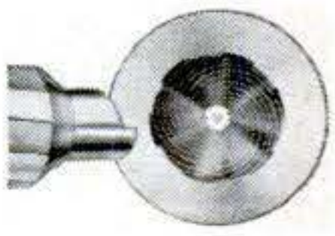

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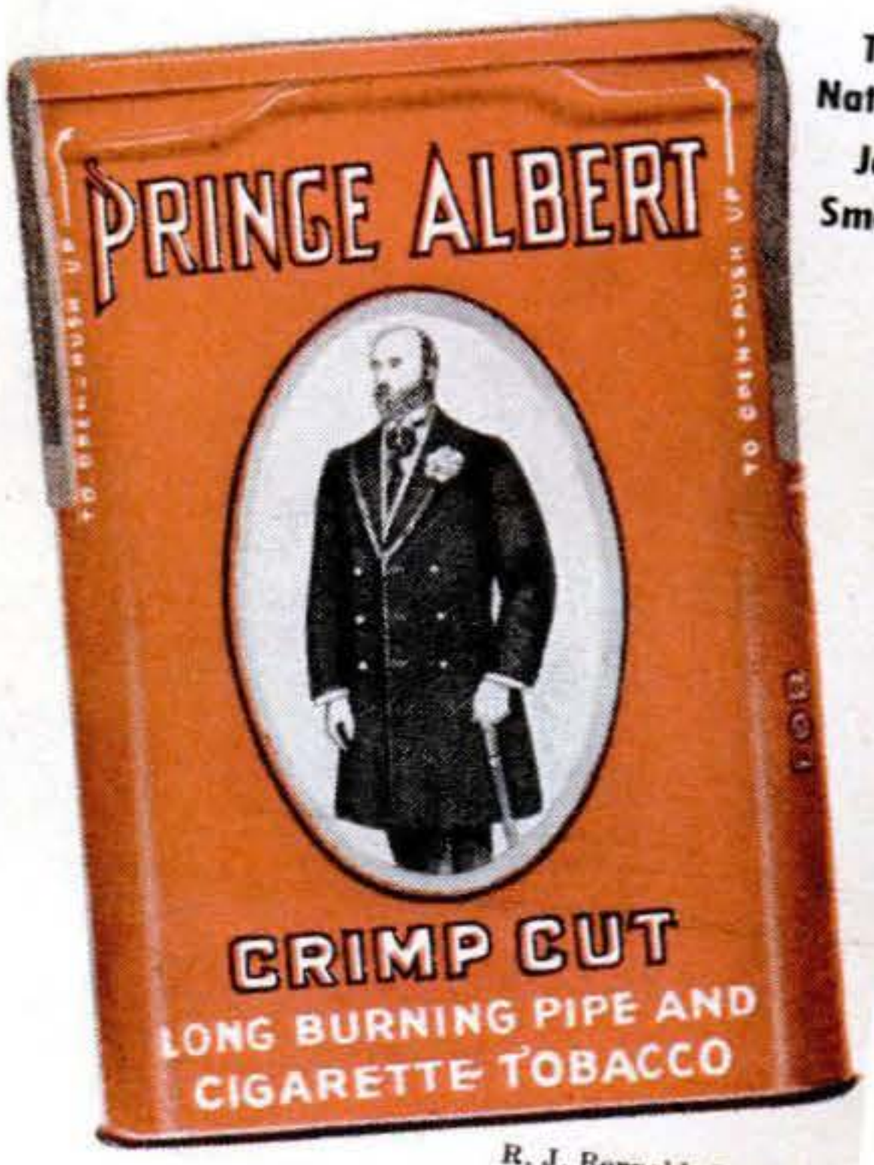
a bit about "Bite"

SOME FOODS taste better when the "bite" of mustard, horse-radish or sauce is added!

SMOKING TOBACCO tastes better when the "bite" is out! Prince Albert is specially treated to insure against tongue bite!

BITE'S OUT PLEASURE'S IN

there's more tobacco in every tin!



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More Men Smoke

PRINCE ALBERT

than any other tobacco

R. J. Reynolds Tob. Co., Winston-Salem, N. C.

POPULAR SCIENCE
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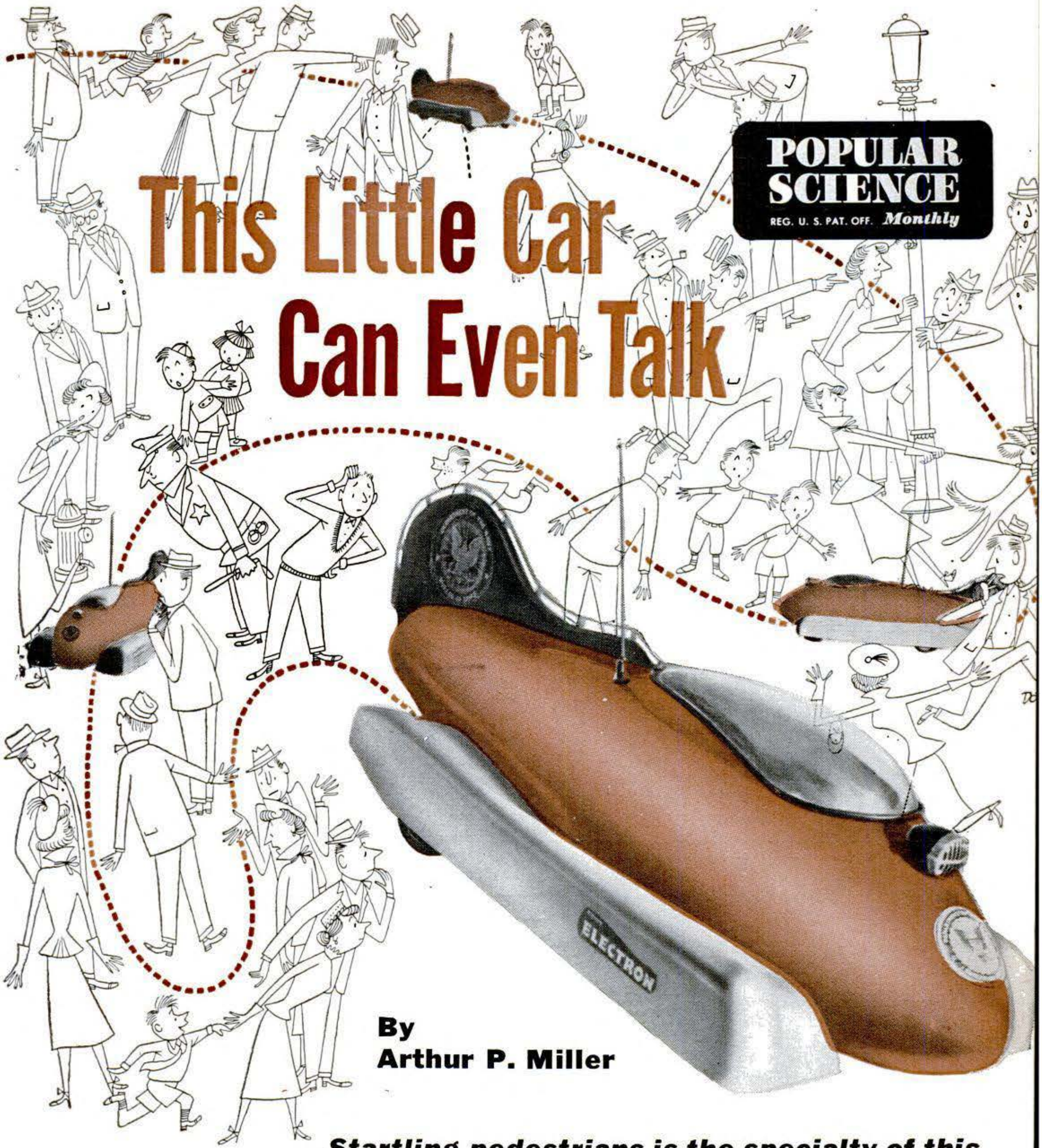
This Little Car Can Even Talk



By
Arthur P. Miller

Startling pedestrians is the specialty of this midget auto used by the Navy to demonstrate radio control.

A CHESAPEAKE retriever, strolling on a leash at Bolling Air Force Base near Washington, D. C., the other day, almost pulled his mistress off her feet when a pint-sized automobile began barking at him.

The dog was no dope. The bark sounded like the genuine article. But it came from a radio receiver hidden in the miniature car. It originated in the throat of a playful Navy man sitting at a microphone in a remote-control station on a truck a block away.

The barking car is the Navy's newest novelty. It not only barks, it talks too. And it runs. It starts, stops, turns and backs up with nothing in the driver's seat but thin air.

The Electron, as the midget is called, was constructed to show what the Navy is doing in the field of radio control. The system used to guide the car could just as well be used to direct a full-scale drone aircraft or a guided missile.

Built by Allen Yurek, electronics engineer at the Washington Naval Gun Factory; George Crowther, an expert machinist; and Leon Neal, an electrical technician; it has been exhibited recently to the amazement

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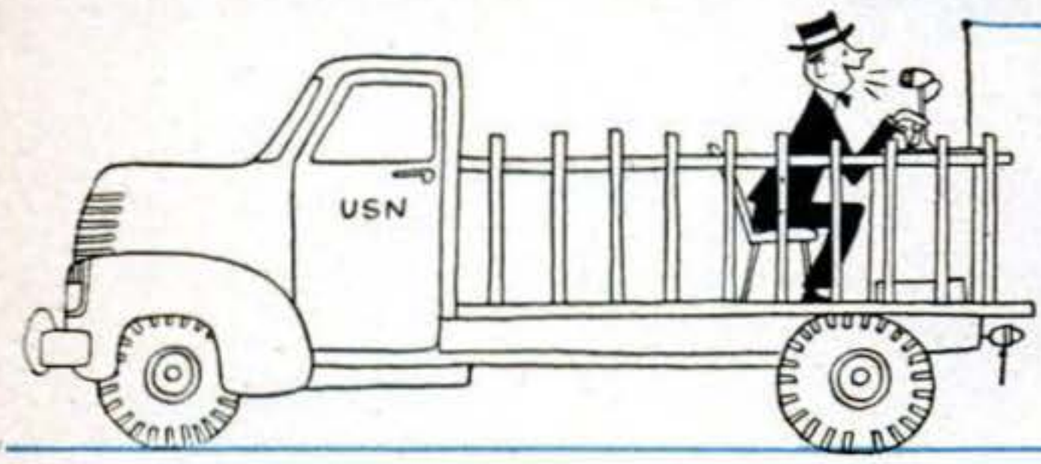

OPERATOR sits at panel containing a pair of two-way toggle switches, a push button, a microphone. A red light glows beneath car's transparent canopy to tell him when handie-talkie is on "Talk."

of citizens from New York to Dallas.

This robot of the road has one big advantage over similar radio-controlled miniatures: it runs off an ordinary six-volt automobile storage battery. Most others have needed at least a 24-volt aircraft battery to get the desired action. There are, however, auxiliary batteries to boost speed by increasing the voltage to the main drive motor.

"Driving" the car is simple. The operator slides into his seat behind a small panel in the back end of the truck. To make the car move forward he pushes one of two toggle switches, closing the circuit between a low-power transmitter and one of five oscillators.

The transmitter sends out its carrier signal modulated by the oscillator tone. The five oscillators—one for each of the car's actions—are set at staggered frequencies ranging from 125 cycles to 1,030. This modulated carrier tone is then picked up by the car's sensitive receiver, which feeds it to five tone filters corresponding to the oscillators. One of the filters accepts the "move forward" signal and feeds it to relays that energize the main drive motor.

Power is transmitted to the car's rear wheels by an honest-to-goodness differential. The drive motor generates 1/25 horsepower. That's enough to accelerate the midget to top speed in 30 seconds.

Steering is handled by a small motor like the ones that work the tops on Ford convertibles. When the toggle is thrown one way by the operator, the motor drives a worm gear which is linked to the front wheels. When the inside wheel reaches its maximum turn position, a lug trips a microswitch, cutting off power from the motor. A second microswitch cuts off the power in the other direction.

How Talk Was Added

But the most unusual thing about this wonder-bus is its ability to talk. To make a conversationalist out of the car was not easy. "We wanted to use a standard Army handie-talkie," says Yurek, "but we had to find some way to push the small lever at one side from 'Talk' to 'Listen' and back again."

After several huddles, they hit upon the solution. To another convertible-top motor they attached a worm gear. The worm was

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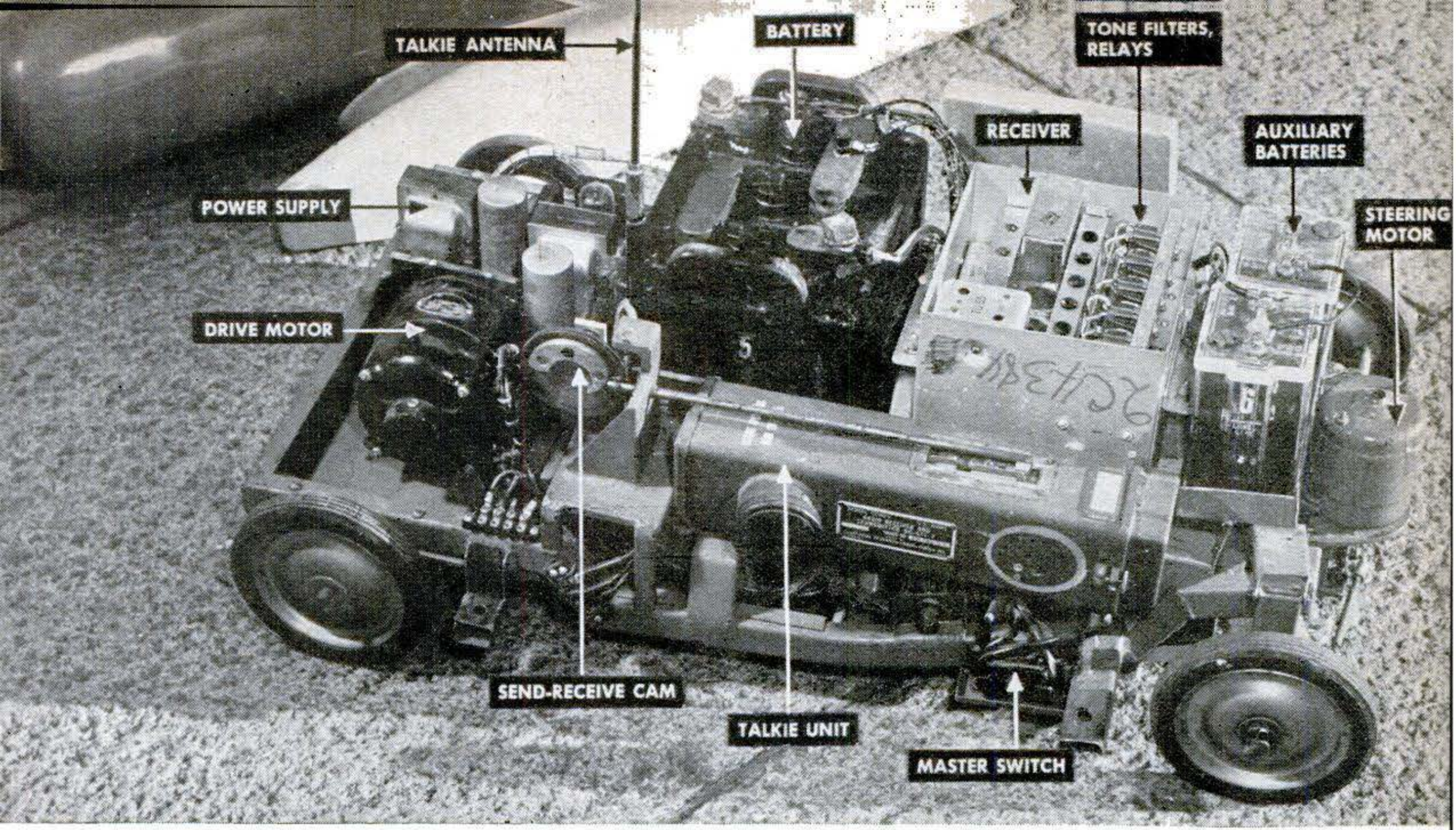
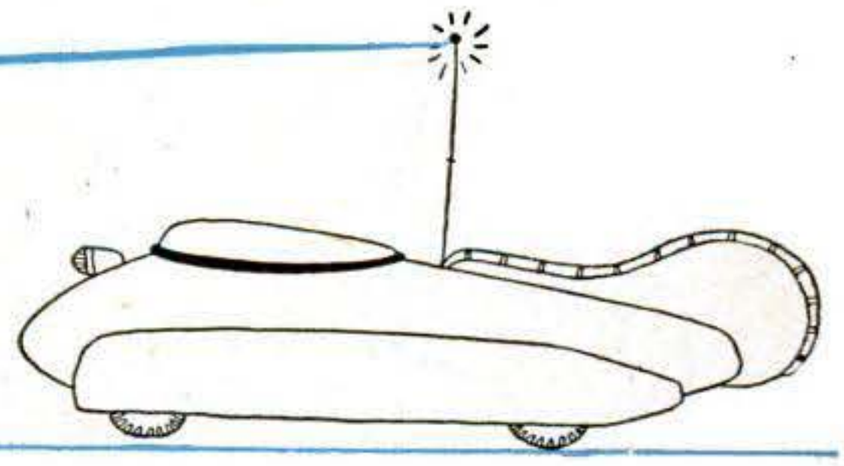


CAR'S INSIDES are complex only at first glance. Drive motor is old 110-volt DC job, rewound to operate on six volts. Midget weighs 65 pounds, battery accounting for 30. Length is 38 inches.



cut to mesh with a pinion to which a half-moon-shaped cam was bolted. As this cam turns in response to the motor, it pushes back and forth a rod that is attached at its far end to the talk-listen switch. With each 180-degree turn of the cam, the switch—operated by a push button—flips from "Talk" to "Listen."

Body Came from a Dump

The Electron was built in three months. Yurek, Crowther and Neal made it mostly in spare moments. For the teardrop-shaped body they trimmed down an aircraft wing tank that they found in a dump.

A strip of aluminum, mounted on spacers, serves as the remote-control antenna. A separate spear antenna for the handie-talkie sticks up directly behind the cockpit. The cockpit itself is plastic, heated and formed over a wooden mold.

The chassis, of 18-gauge sheet steel, is mounted in front on two coil springs. The wheels are the six-inch scooter type.

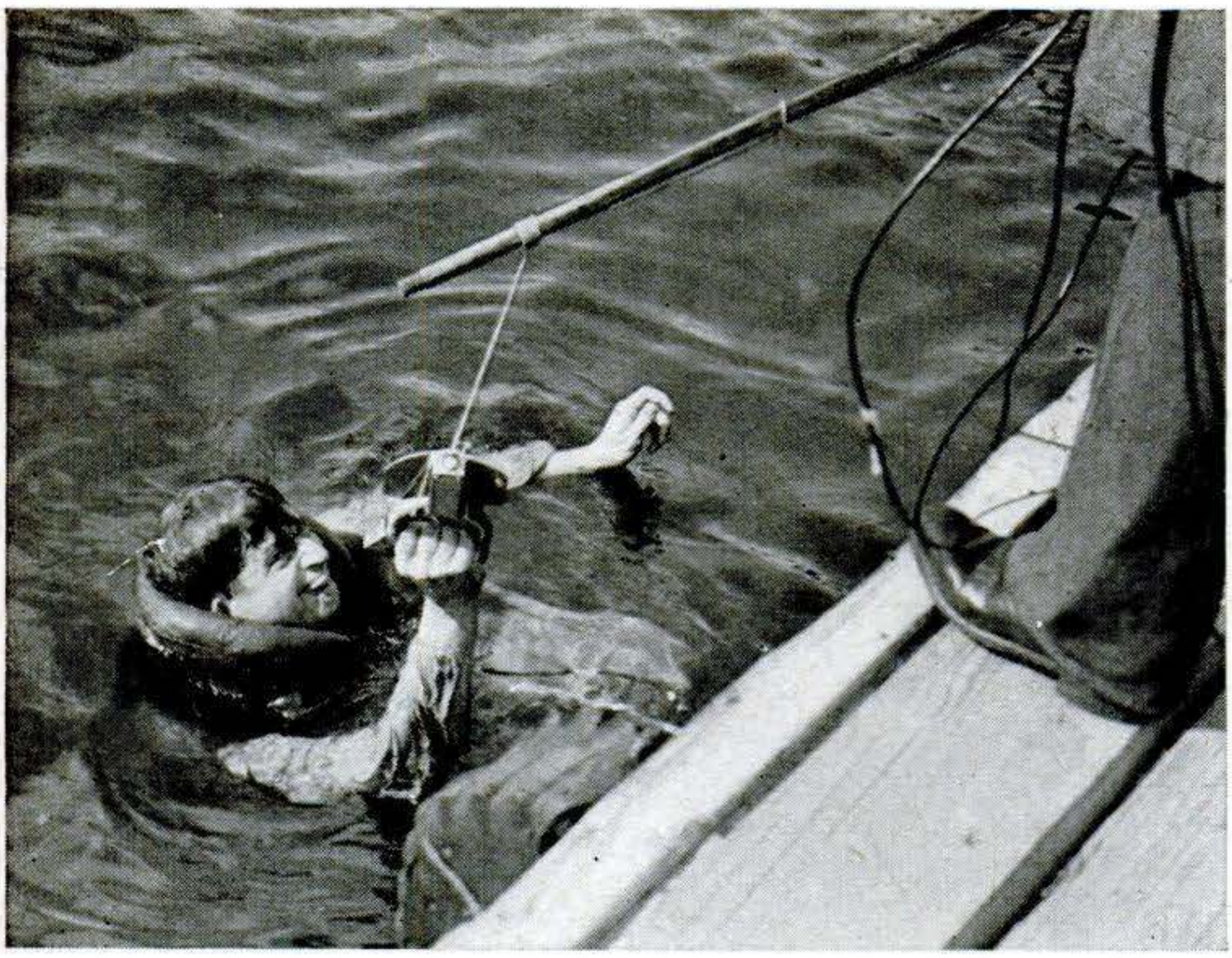
The radio-control system works best only when the car is in the line of sight, though it will bend somewhat around corners if the signal does not encounter any steel barrier.

Another feature of the versatile midget's control system is its ability to work despite interference. Many remote systems can be fouled up by as small a disturbance as a vacuum cleaner. With this car, however, the operator has positive control at all times.

The Navy feels its Electron proves a point. The possibilities of a remote-control system such as this one are almost limitless.

Ask the Chesapeake retriever! END

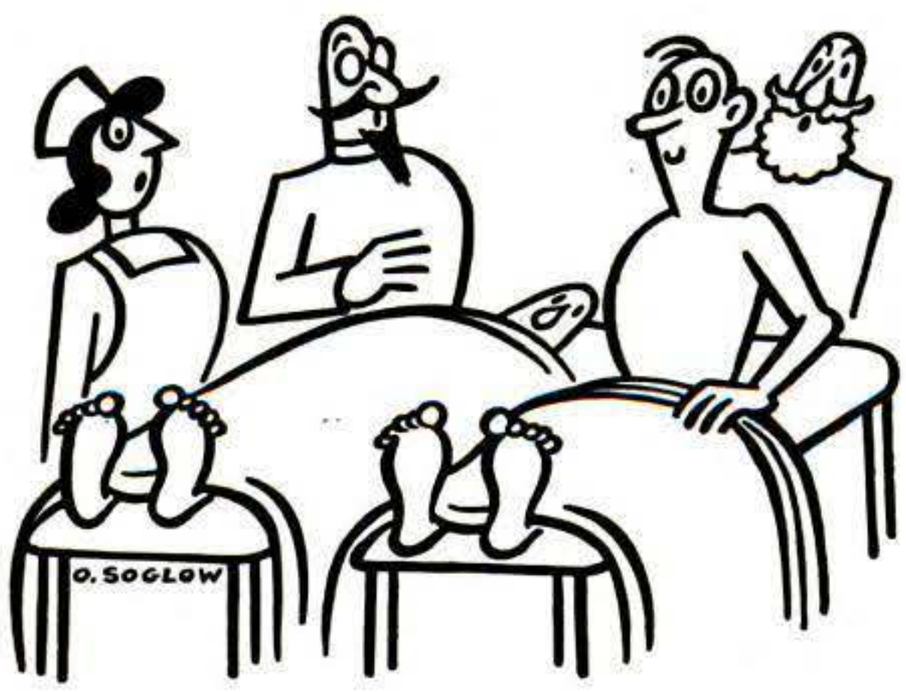
BYSTANDERS' MAIN INTEREST is car's voice. A hobbyist could buy parts for duplicate for $250. Body, chassis would be extra.



M. D. Is Guinea Pig in Cold-Water Test

DR. DAVID MINARD spent 40 minutes in 38° water—so cold that he couldn't talk at first—to learn how long a man can stand such icy immersion. He suffered no permanent harm, although his fingers tingled for two months afterward.

At left the Navy physician is shown trying his arm muscles on a grip tester as he floats in the frigid harbor of Argentia, Nfld. His strength decreased sharply after 25 minutes in the water.



75 years ago this month

Popular Science Monthly reported:

"A CASE of successful transfusion of blood is recorded in the *Lancet*—the patient a clerk twenty years of age. The pulse was very feeble, rate 70, respiration 24. His state was one of profound anemia. A student in St. Thomas's Hospital volunteered to supply the blood for the operation. The patient received 200 grams of blood without showing any bad symptoms. Three hours after the operation, the patient had a full pulse, rate 90, respiration 28. The process of transfusion was to be repeated by the physicians, the results being so encouraging."

Automatic Pilot Steers Duck

THE two comfort-loving anglers in the bottom photo below do their trolling from a robot-controlled amphibious truck. They neither row nor steer, and have plenty of room to relax. Bill Hibbard, a research technician for Minneapolis-Honeywell, installed an automatic bomber pilot in the surplus boat, owned by Charles Melony. The robot control (arrow) keeps them on a straight course in the water. A remote steering knob, held by girl in top photo, lets them change course from their fishing positions.

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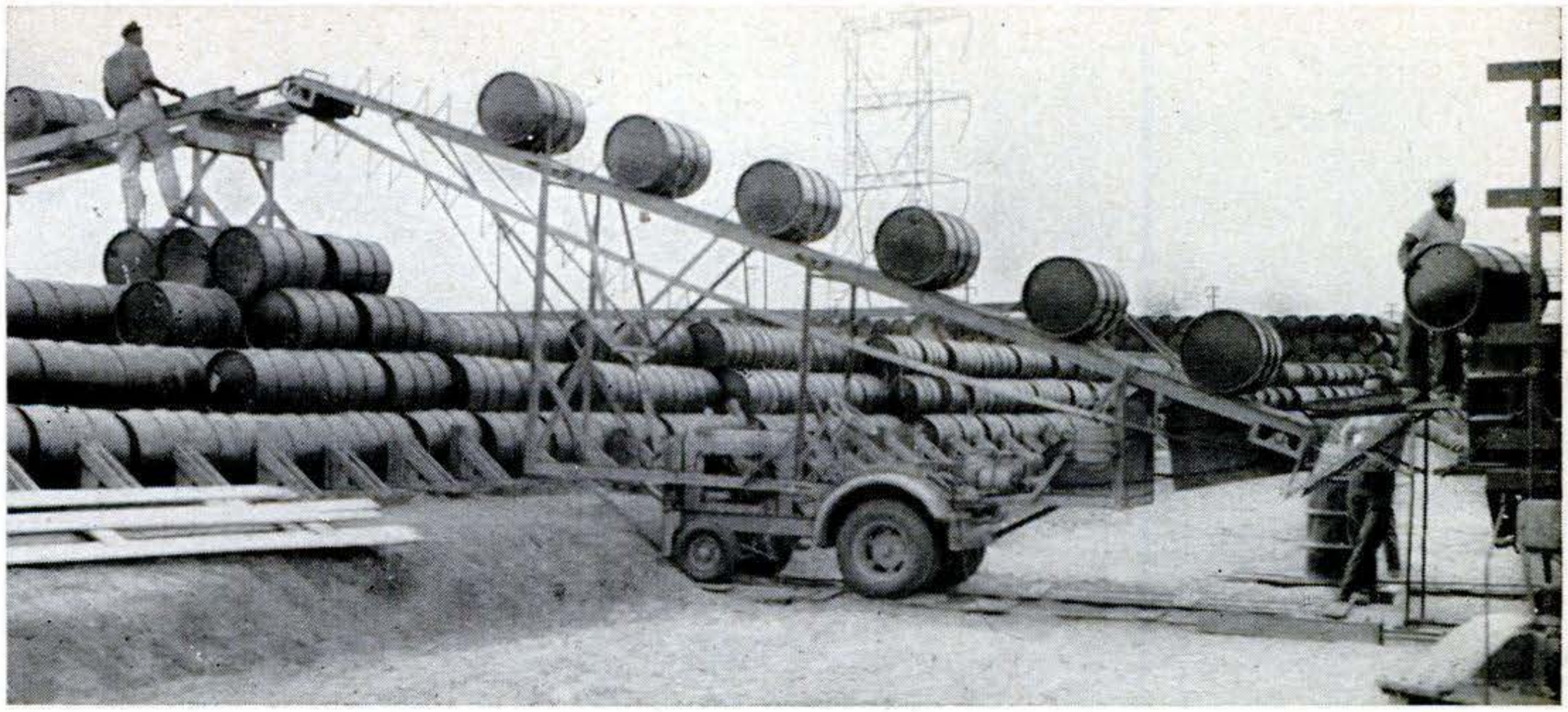
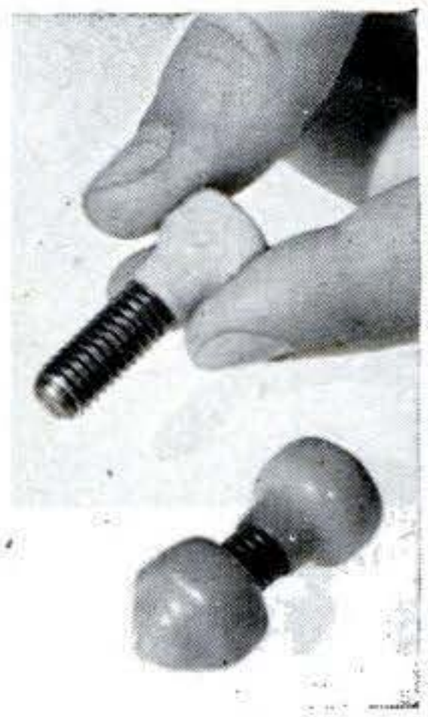


Conveyor Stacks Barrels Fast

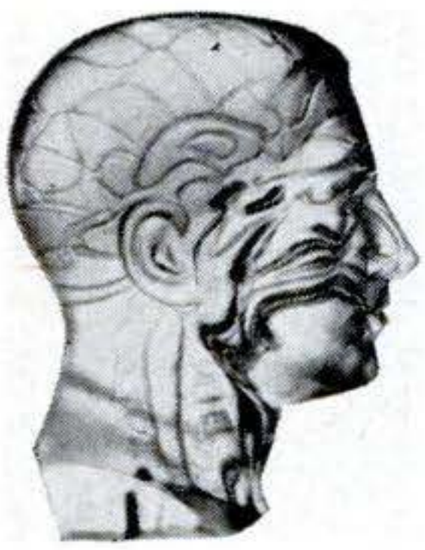
How to stack 150,000 oil drums faster with fewer men—that was the problem facing workers at Cheli Air Force Depot in Maywood, Calif. George Timberlake, civilian engineer, came up with this portable belt conveyor. Bolted to a warehouse tug, it rides to any location to carry drums from truck to loading platform or to the top of a storage pile. An electric motor, powered by a portable generator, moves the belt in either direction. It works at any angle, loading uphill or down, and does the job twice as fast with half the men.

Bolts Made Corrosion-Proof



VINYL plastic casings on these bolts and nuts of low-carbon steel protect them against corrosive chemicals at high temperatures—a combination that will attack most metals in a short time. Made by Steere Enterprises, Akron, they are now used in rayon-processing vats.

Model Is Medics' Target Range



THIS plastic head will help teach medical students and doctors how to aim powerful and penetrating rays with pin-point accuracy from outside the head onto tumors within. Light bulbs in the Bakelite head illuminate areas affected by growths. The instructor, directing a narrow beam of light on the translucent model, can demonstrate the correct path rays should take to reach any area to be treated.

Towels Trap Hospital Static

WHAT appear to be carelessly dropped cloths above are wet towels deliberately placed to ground the operating table and anesthesia machine. This is one of several precautions recommended to hospitals by the Bureau of Mines to prevent anesthesia explosions caused by static electricity.

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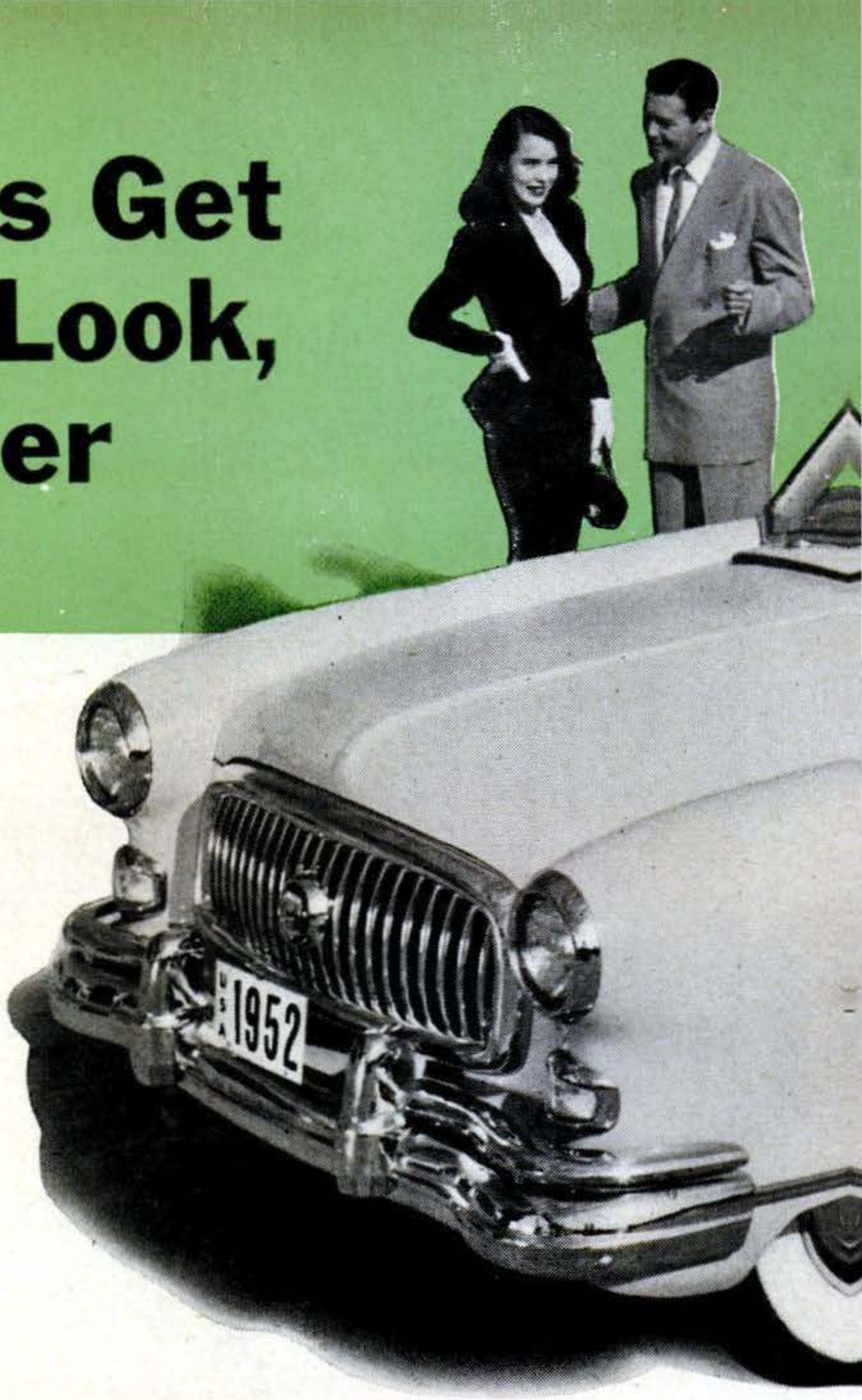
'52 Nashes Get European Look, More Power

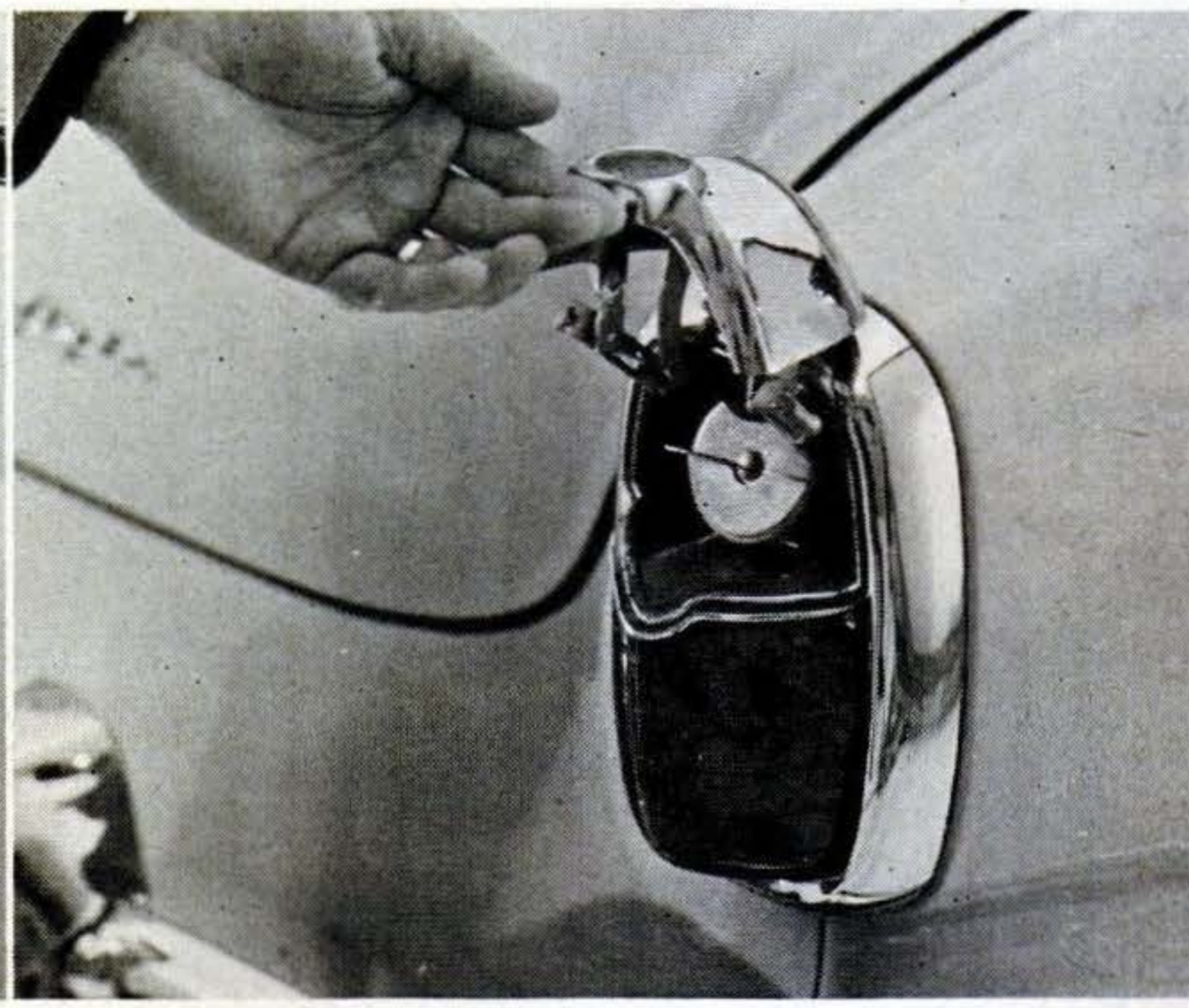


THAT European look—a low hood and high fenders—distinguishes the 1952 Nash and Nash-Healey lines of cars. All of them, in fact, were styled by one of Europe's most famous designers, Pinin Farina of Italy.

The standard Nash sedans have more glass area in the windows and windshield, narrower windshield and center pillars, and boosted horsepower in both the Ambassador and Statesman models. The Ambassador's six-cylinder overhead-valve engine has 120 horsepower compared with last year's 115, the Statesman's L-head 88 horsepower compared with 85.

The Nash-Healey is the sports car introduced last year. Engine and major mechanical parts are made here, chassis and suspension in England, body in Italy.

SOMETHING NEW in a door handle. Just squeeze it and the door opens. Statesman's wheelbase is increased to 114¼ inches. Automatic transmission is optional in both models.



FILLING-STATION OPERATORS may have to search for gas filler cap. It's under top of right tail light. For better listening, radios have two speakers, one at each end of dash.

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NEW NASHES are sparing of chrome except for front ends and narrow bumper strip on sides. Air scoop for ventilation and heat, just below windshield, extends full width of hood.

WITH FARINA DESIGN, Nash has dressed up only production sports car bearing name of a U.S. manufacturer. Chassis, by Donald Healey, is like that of British road racers. Overhead-valve engine basically is six-cylinder Ambassador, but compression ratio is upped to 8.1 to 1. It has two British horizontal carburetors, an oversized intake manifold.

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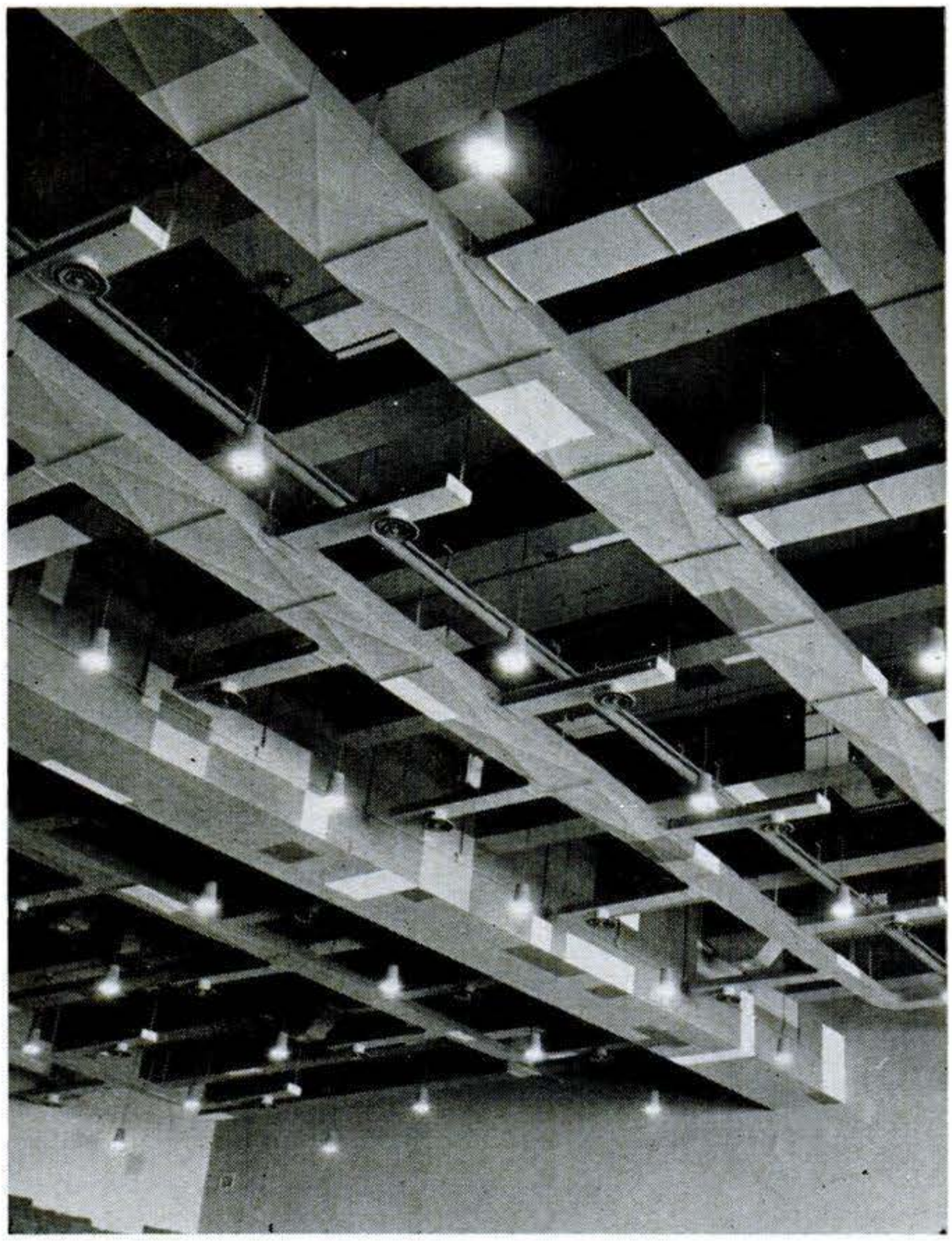
Ceiling in New United Nations Building Left Unfinished on Purpose

THE innards of half the ceiling of a huge new room at United Nations Headquarters in New York are deliberately left exposed. Sven Markelius, noted Swedish architect, planned it that way. It covers the 72- by 145-foot meeting room of the UN Economic and Social Council in the Conference Area.

Newspapermen and visitors who attend future Council meetings will sit under a naked-looking collection of lighting conduits, beams, girders, pipes and air-conditioning ducts and diffusers. The entire layout is painted battleship gray with patches of darker gray and of white. Viewed from underneath as in this photo, it looks like an abstract painting. Markelius left it open because the floor beneath slopes upward and the seats are banked like those in a movie. He wanted to give spectators and press a feeling of spaciousness. Above the delegates' seating section the ceiling is covered.



Germany Introduces Its Own Four-Cylinder Ford

THE Taunus, two-door sedan above, was recently shown in Germany by the German Ford Co. It has a 38-horsepower, four-cylinder engine. The car is said to attain a maximum speed of about 68 miles an hour and to run 30 miles on a gallon of gas. It sells for 7,350 marks (about $1,750) without accessories.

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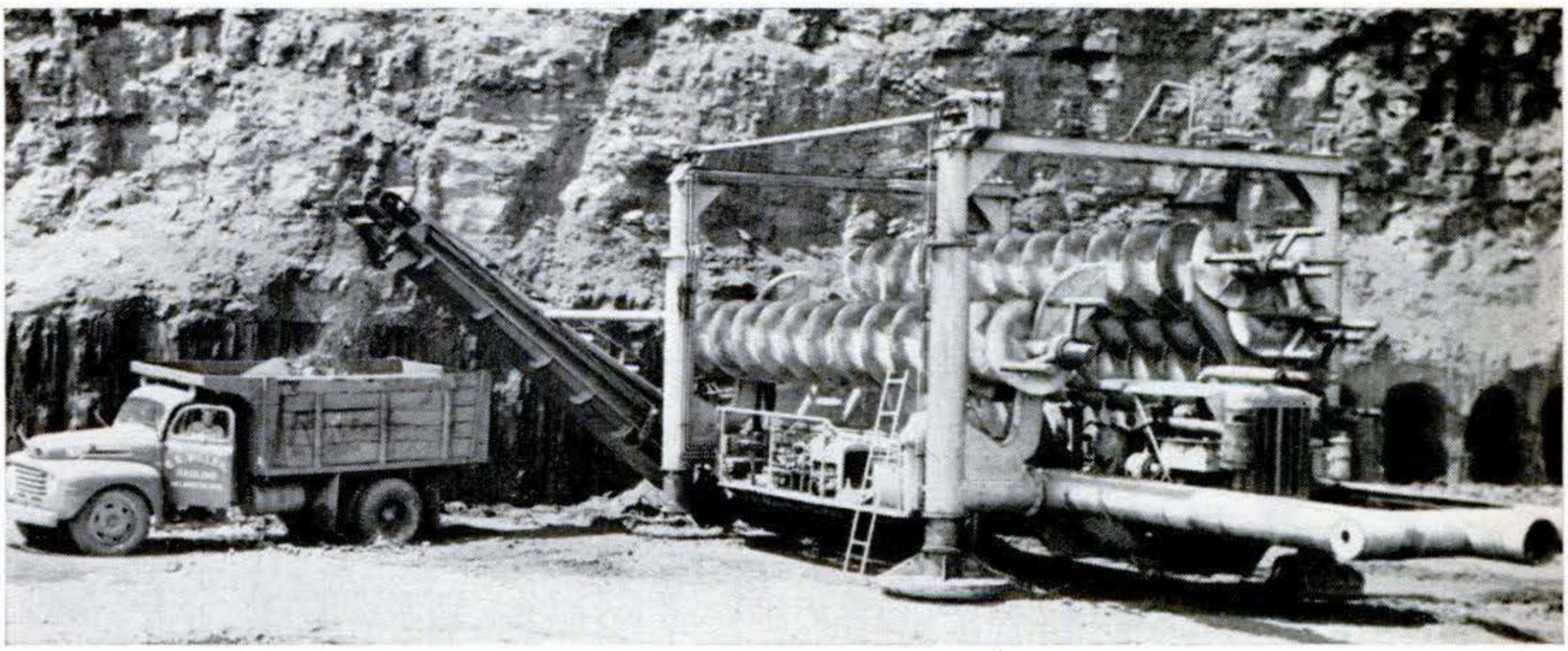
Vacuum Cleaner Pumps for Him

AN ENTHUSIASTIC Berlin accordionist, Helmut Finke, found his enthusiasm waned the longer he pushed and pulled the bellows. So he rigged up a vacuum cleaner to do the work for him. A pedal controls volume by changing the flow of air through the hose inserted in the accordion.

'Copter Strings Aerial Cable

A HELICOPTER—that aerial jack-of-all-trades—is shown above stringing cable 1,250 feet across a densely wooded valley in England. The 'copter pulled a cord across from one tower to another. Workmen (on tower) caught the cord to which the cable was attached. A winch drew the cable across.



Giant Auger Digs Out Coal

THIS mechanical miner drills holes into horizontal coal seams and brings the coal out in a continuous stream. As it bores in, the huge augers, each 52 inches in diameter, are lowered into place, one behind the other, by hydraulic hoists. Four hydraulic jacks line up the lead auger with the coal seam and a tractor-dozer supplies thrust for boring. The Grafton Coal Co., Clarksburg, W. Va., developed the equipment, which produces 700 tons of coal a shift.

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CLOTHING A MAN PACKS FOR A WEEK'S TRIP

NATURAL FABRICS

- 1 SUIT
- 6 SHIRTS
- 6 PAIRS SOCKS
- 6 SETS UNDERWEAR
- 1 TIE
- 1 PAIR PAJAMAS

SYNTHETIC FABRICS

- 1 SHIRT
- 1 PAIR SOCKS
- 1 SET UNDERWEAR
- 1 PAIR PAJAMAS

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New Suits Stay Pressed All Summer

Synthetic fabrics also make ties that won't wrinkle, socks that won't shrink and shirts that iron themselves.

By Harland Manchester

IN OFFICES, shops, clubs and locker rooms this summer you'll see men pointing to the creases in their trousers, peeling off their jackets to display their shirts, and lifting their cuffs to show off the sterling merits of their socks. This will not mean that the American male has suddenly gone foppish—he will be talking about the sensational new synthetic materials which are rapidly revolutionizing men's wardrobes.

Super fabrics from oil, coal and natural gas will soon clothe a man from the skin out better than he has ever been dressed before. In the last few years, hundreds of millions of dollars have been spent by chemical firms and clothing manufacturers to bring forth the new man-made textiles and now the finished products are beginning to trickle through to the retail stores. Some of the coveted garments are in short supply, awaiting the completion of big new plants, but before long you'll see the results everywhere.

Suits You Can Swim in

You'll see crowds of men at baseball games and on trains and subways looking as fresh as if they had stepped out of a bandbox. Wrinkled and baggy clothes will be gone forever. Garments will not shrink, and moths will starve to death. Spots will come out like magic. Tailor bills and laundry bills will be cut in half, and housewives will have less work to do. Cumbersome baggage will be a thing of the past, and businessmen carrying only briefcases will return from three-week trips looking as fresh as when they left home.

Half a dozen new fabrics and treatments have combined to launch this sartorial millennium. The newest and most spectacular fabric is Dacron.

When Dr. Wallace Carothers of du Pont discovered nylon in the early '30s, he also laid the chemical foundation for the promising filament now called Dacron. Nylon got the green light, and proceeded to take over the market of the silkworm. Since then, English chemists have made cloth from Carothers' "sleeper," and at the close of the war, du Pont took it off the shelf and got busy.

Chemists were excited because of the resilience of the new fiber. They predicted that it could be made into a sturdy, long-wearing cloth that would keep its shape better than any known material. Such a cloth would resist wrinkling and, if wrinkled, would quickly recover. They turned out enough Dacron in the laboratory to make a few suits.

Two years ago a few score of salesmen and executives began giving the suits rough usage on the road. One man wore his powder blue, summer-weight Dacron suit 57

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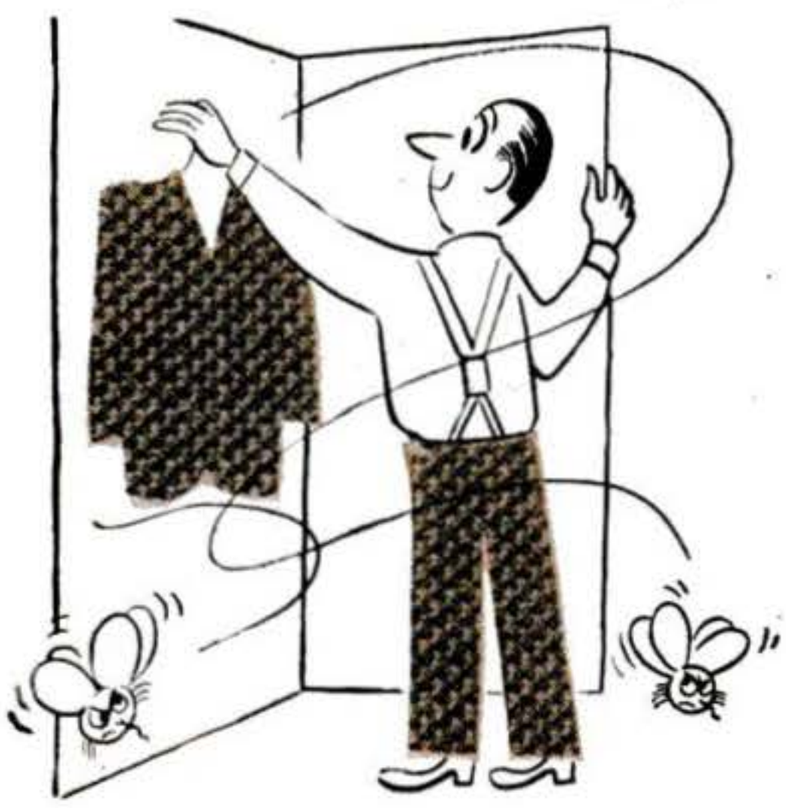
days without a press, riding in trains, planes and automobiles. For good measure, he jumped into two swimming pools fully clad. Then they took the suit and put it on a dummy in a swank exhibition room. It still looked presentable enough to wear anywhere.

Dacron suits, like others, will wrinkle a little the first day of wear, but most of the wrinkles come out at night. While most suits, if worn continuously without pressing, keep on losing their shape until they look like sacks draped over hydrants, Dacron day after day looks like a suit just comfortably broken in.

The time came for a sneak preview, and in 1950 material for 200 suits was sent to Witty Brothers, New York tailors. They made them up and put a one-day ad in the *Times*. As a consumer test it was a failure, for word had leaked out, and within 24 hours the suits were grabbed up by competitors' comparison shoppers and by Wall Street prospectors who were watching du Pont stock.



New Colors, More Patterns

Last year, Witty Brothers, who have sole rights for the 100-percent Dacron fabric for men's suits and slacks, sold 2,000 summer-weight suits for $90 each. This year they got enough material for 7,500 suits and 7,500 pairs of slacks, which are on sale in large cities throughout the country.

Last year's Dacron suits were either solid light blue or brown because problems of dyeing the new fabric had not been completely solved. Now the suits, slightly less expensive, appear in many shades, as well as in stripes, plaids and crash weaves. Also on the way are attractive white Dacron tuxedo jackets and full-weight midnight blue evening clothes which look like their woolen counterparts and keep a press indefinitely.

The new fabric will not be plentiful until du Pont's new $33,000,000 Dacron plant, now being built in Kingston, N.C., goes into production in mid-1953.

Stains and Moths Get Nowhere

There are few limits to Dacron's versatility. Witty Brothers' vice-president Spencer Witty took a pair of light tan slacks out of stock and emptied his fountain pen on one leg. The material sucked up the ink like blotting paper. Then he took the slacks to the washroom and rinsed them out in cold water with no soap, wringing them dry by hand. When he shook them out, the ink splotch was gone, the creases were sharp and the legs hung as flat as twin envelopes. Three hours later they were dry and immaculate. But he doesn't endorse the trick as standard procedure: some inks might not come out. Egg and catchup stains and all manner of water-soluble messes can be quickly and completely removed from Dacron with soap and water; hydrocarbon oils and greases must be removed by an appropriate solvent such as your cleaner uses.

Long wear is another Dacron advantage. These summer suits have been worn 200 to 300 days without looking shabby. When a suit is not worn continuously, a man seldom counts the number of days it lasts, but it is safe to say that few woolen tropicals will go more than 100 days without showing signs of wear. The makers believe that Dacron should wear at least twice as long as wool. All suits sold so far have been of eight-ounces-to-the-yard material, which is a light summer fabric, but a few full-weight suits suitable for winter have been made and have proved satisfactory.

Scientific experts differ concerning the

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comparative warmth of wool and Dacron, but men who have worn the new suits in cold weather say they are comfortable. When the new fabric is plentiful, Dacron suits, slacks and topcoats will be made in all weights, colors and patterns.

Dacron is highly resistant to shrinking. Wear a suit long enough and it may shrink a little, but you won't notice it. It is highly moth-resistant, for it contains no nourishment for the insects.

No fabric is perfect, and a few warnings go with Dacron. If you are careless with a pipe or cigarette, you can burn a hole in a Dacron suit faster than in wool. It is a thermoplastic material, which means that it will melt if heated enough—a too-hot iron will ruin Dacron the way it does nylon. But Dacron will not flare and is by no means a fire menace. It can be thrown in a tub with impunity, but so far, because of the limited supply, linings and shoulder pads are made of other materials which might not dry out as evenly if soaked too long. To be perfectly safe one should send such suits to the cleaners. Washable slacks with all "findings" of Dacron are now available, and it is expected that in another year there will be enough of the new fabric to line the jackets.

Making a Suit Static-Free

Static electricity sometimes makes synthetic fabrics cling to the body uncomfortably, especially when the weather is dry and cold. A Denver man returned a Dacron suit for this reason. Now a number of firms have worked out chemical antistatic treatments, and the problem seems licked. Another way of beating static is to blend Dacron with a little wool or rayon. This does not alter seriously the virtues of the new fabric.

Dacron shirts, which are much more plentiful than the suits, are causing a sensation wherever men travel. Many men leave on long trips with one extra Dacron shirt when once they packed a dozen cotton ones. At night they wash out a shirt in the bathroom basin and drape it on a hanger; in the morning it is dry and as smooth as new. It has been selling for about $11.00. One purchaser, whose laundry charged him 30 cents a shirt, figured out that after 36 days the Dacron shirt was "his."

Nylon shirts are also fast-drying and easy to wash, but the collars sometimes look crumpled unless they are ironed. Taken all together, the new garments seem bound to solve many problems for the traveler.

The new acrylic synthetic fabrics, chemically different from Dacron, will do many things Dacron will do and have some remarkable special virtues of their own. Among them are du Pont's Orlon and Union Carbide & Carbon's Dynel, already on the market, and Chemstrand, Inc.'s Acrilan, which is soon to go into production.

Men's Orlon shirts, which have been sold for a year or so, are easy to wash, quick-drying, wrinkle-resistant and, like Dacron shirts, popular with travelers who wish to cut down baggage weight. Attractive summer suits of Orlon blended with wool, which have good wrinkle resistance and compete in price with natural fabrics, are on the market. One man wore a sharkskin-type Orlon-wool-blend suit for 53 days without a press. During that time a waiter spilled a glass of milk on it, and he swabbed it off with a napkin. At the end of the ordeal the suit looked unstained and presentable. Summer suits of 100-percent Orlon are on the way, and eventually the material may cover the entire range of men's suitings from summer-weight

[*Continued on page 262*]

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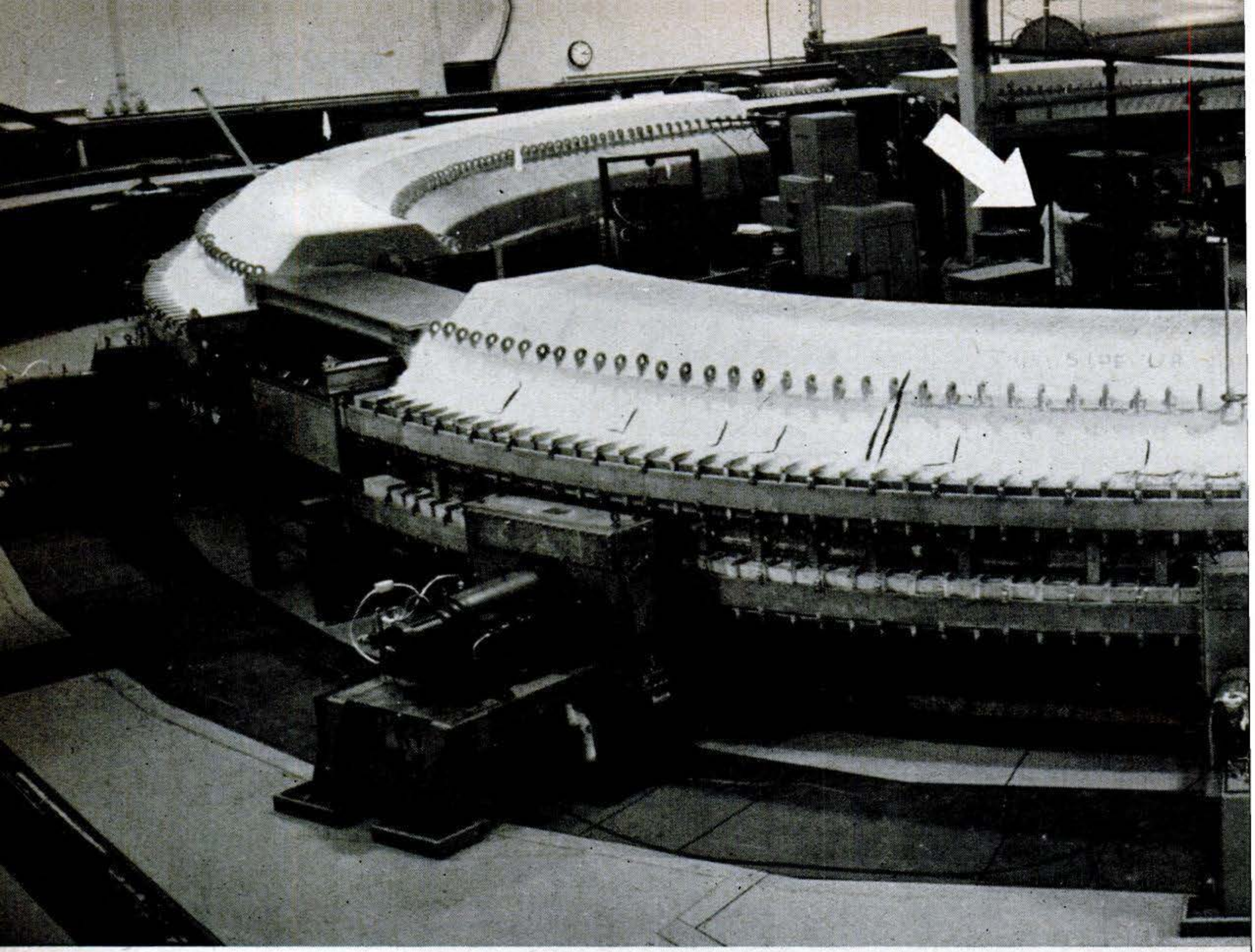

Cosmotron's giant size is shown by comparison with man beside it (arrow). Raceway for atomic

They're Warming Up the World's

First of its type, new Cosmotron aims to hurl atom bolts with power of billions of volts.

SCIENTISTS are grooming for action the most fantastic electric machine in the world. As PSM goes to press, preliminary trials are guiding final adjustments of the $3,000,000, 65-foot-diameter Cosmotron at Brookhaven National Laboratory, Upton, N. Y. If it fulfills its builder's hopes, this monster atom "gun" will attain a power of two to three billion electron volts—five times that reached by any machine to date—and will be the first to hurdle the billion-volt mark.

Billion-volt atomic machines are expected to generate the first artificial cosmic rays that rival nature's in power. They may turn energy into stable, tangible matter—reversing what an atom bomb does.

Everything about the Cosmotron is on a giant scale. The magnet that holds the atomic projectiles on a circular course while they are boosted to nearly the speed of light is wound with "wire" so heavy that a two-foot sample is all you want to lift. As the peak current of 7,000 amperes is thrown into it, the whole magnet creaks, and massive steel bars keep it from tearing itself apart.

Only briefly and intermittently, 12 times a minute, can the mighty current pulse through the magnet—or it would melt the bars. Between pulses, the power is withdrawn from the magnet and stored in a giant

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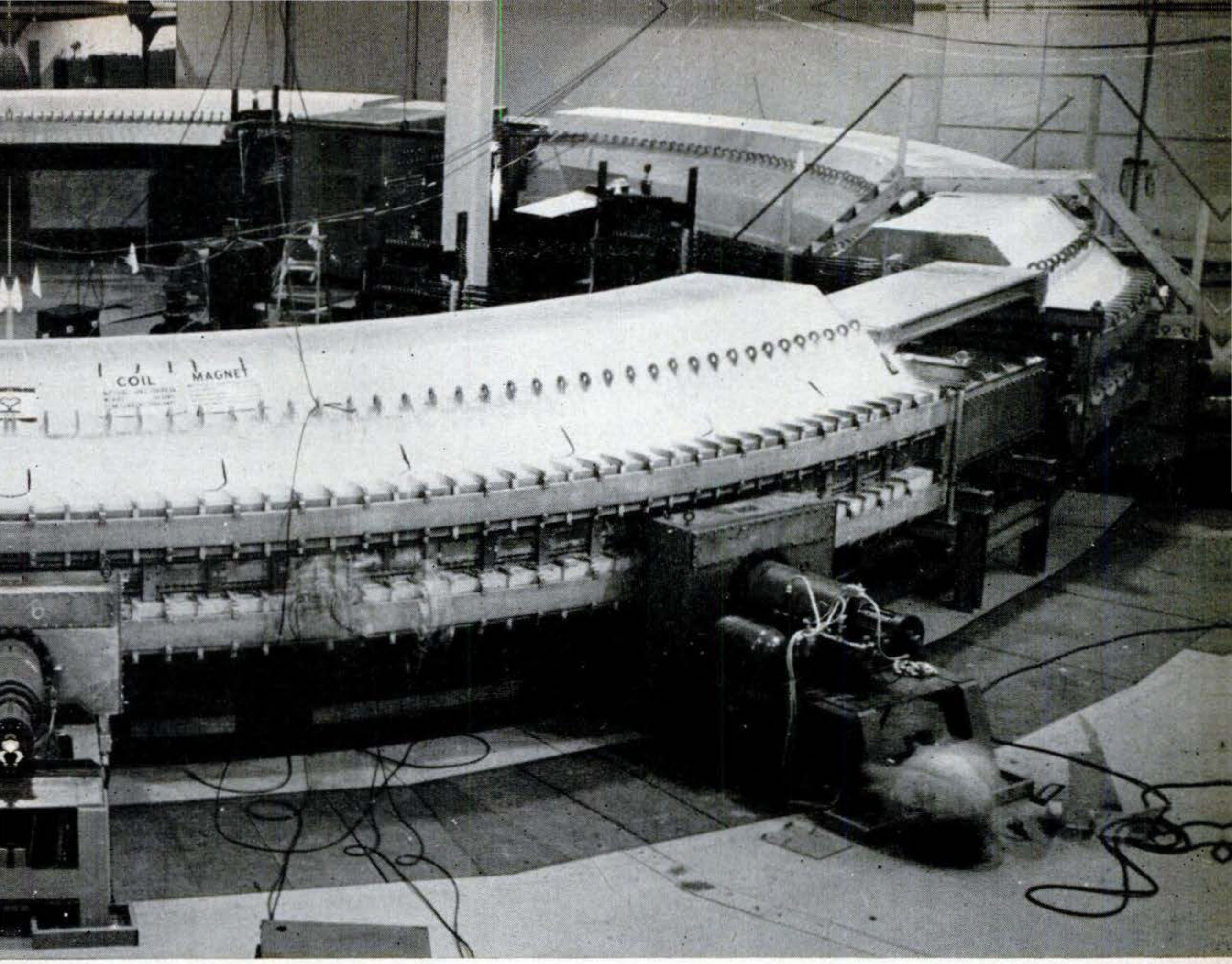
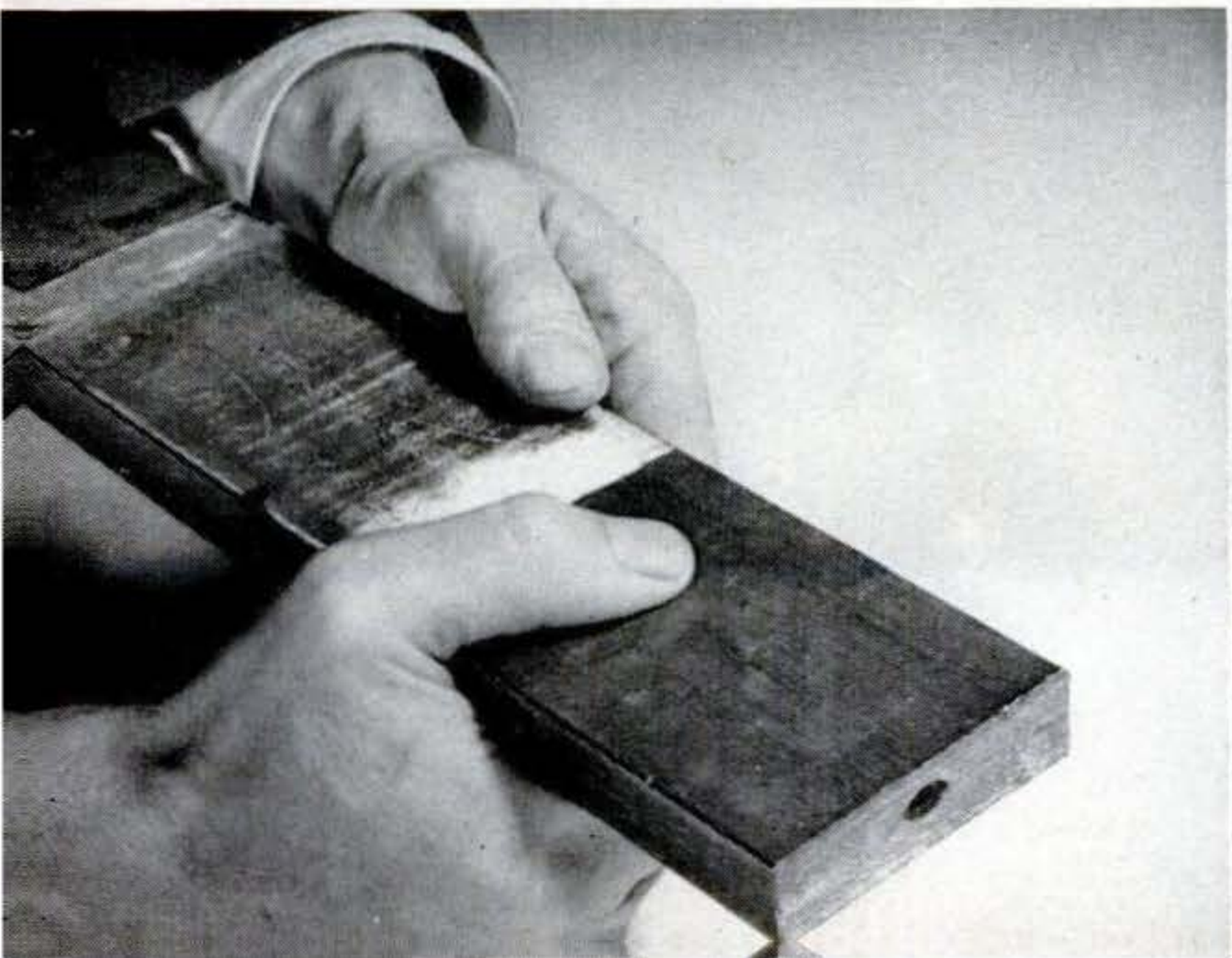


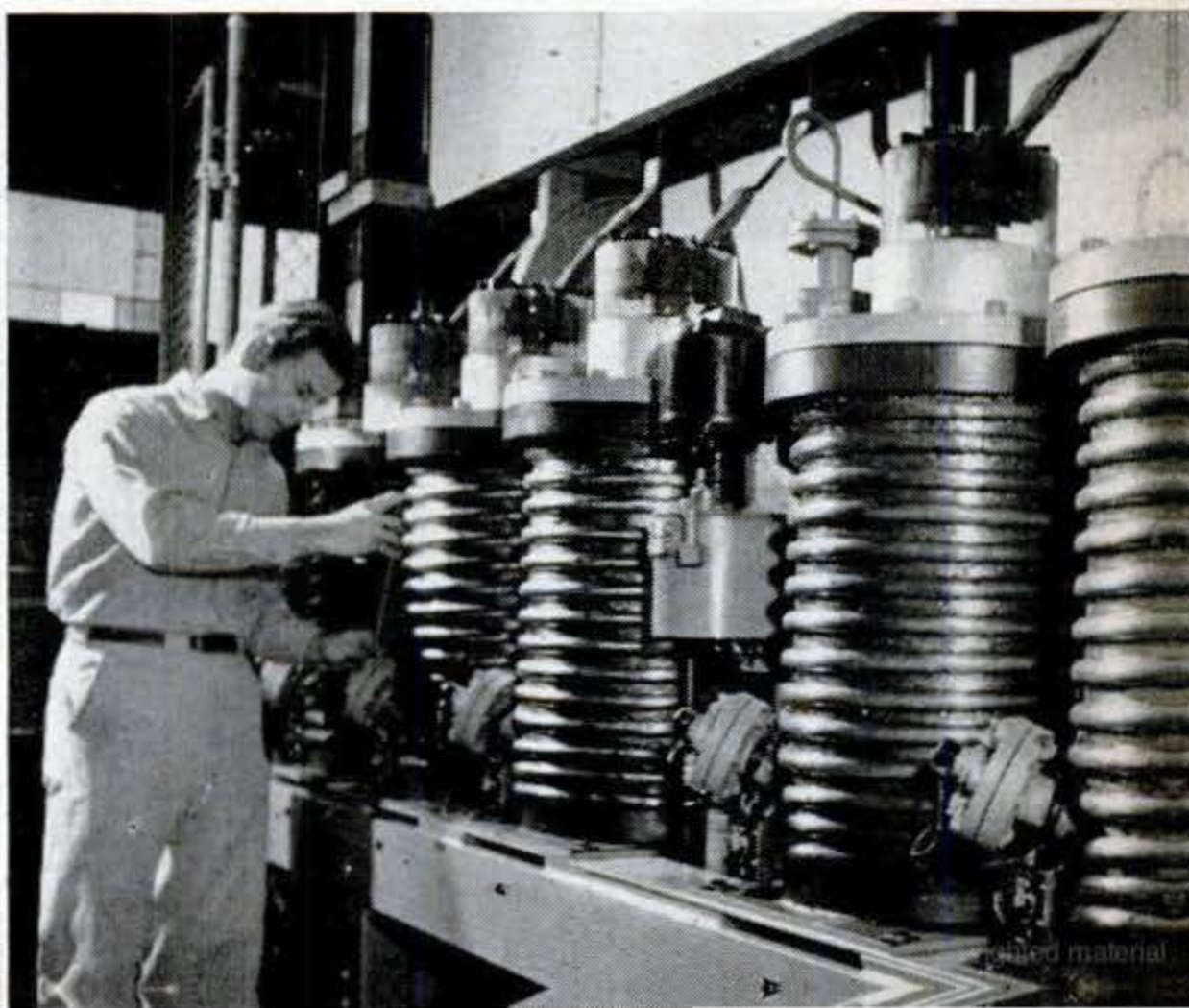
projectiles is within 65-foot-diameter ring magnet. Vacuum pumps are spaced along its rim.

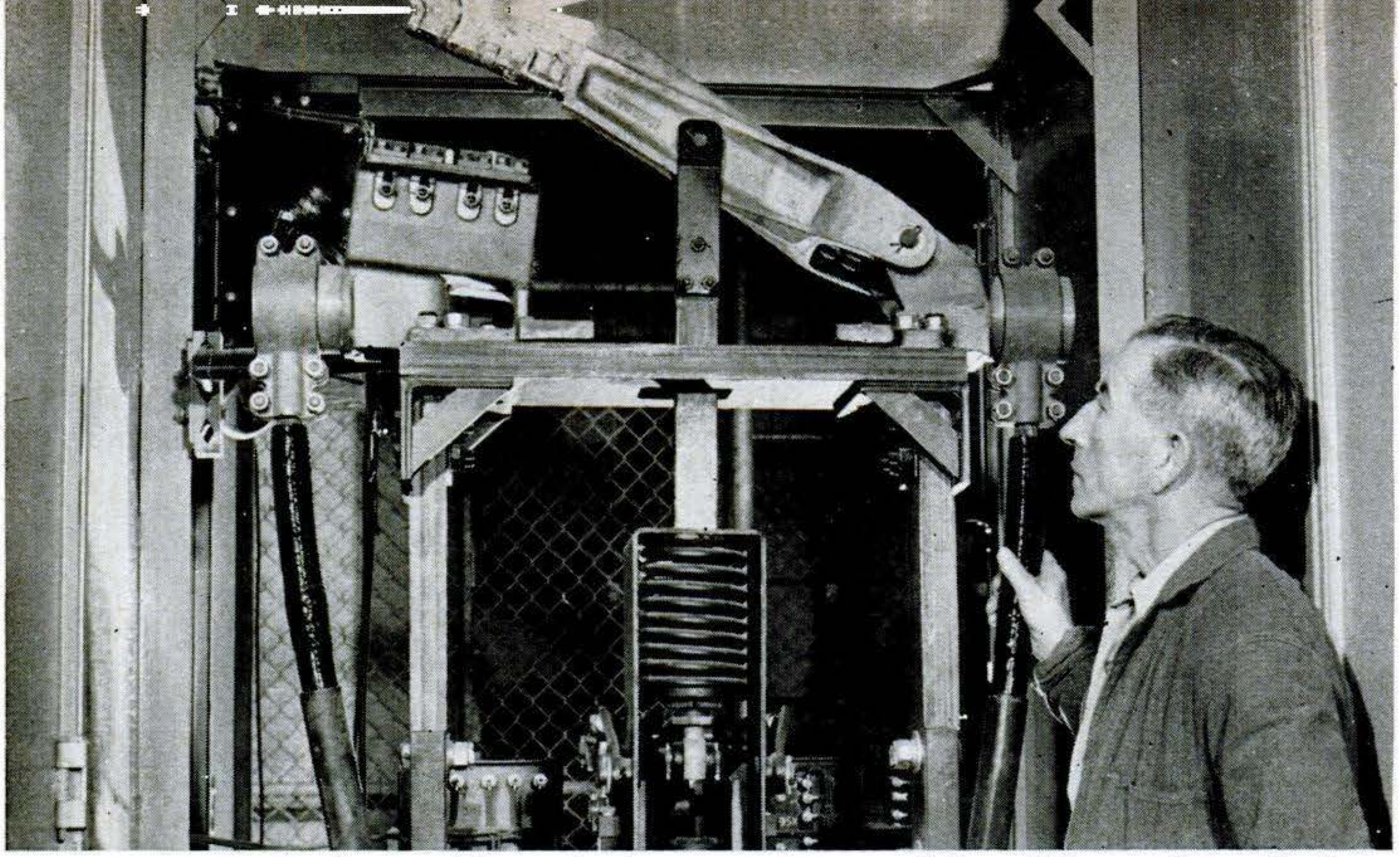
Biggest Slingshot

ELECTRIC "WIRE" for winding the magnet shows what it takes to carry the 7,000-ampere current. Copper bar measures ¾ by 2⅞ inches and has a hole for water cooling.



SELF-REVERSING SWITCHES as large as barrels hurl current into magnet and draw it out again. Called ignitrons, they juggle mighty flow of power with split-second precision.





EMERGENCY SWITCH closes with crash that shakes building, draining current from magnet to ground. It would avert fireworks from arc if magnet winding broke.

nine-foot, 43-ton flywheel. Energy in each pulse is enough to bring a destroyer to 10-knot speed and stop it again!

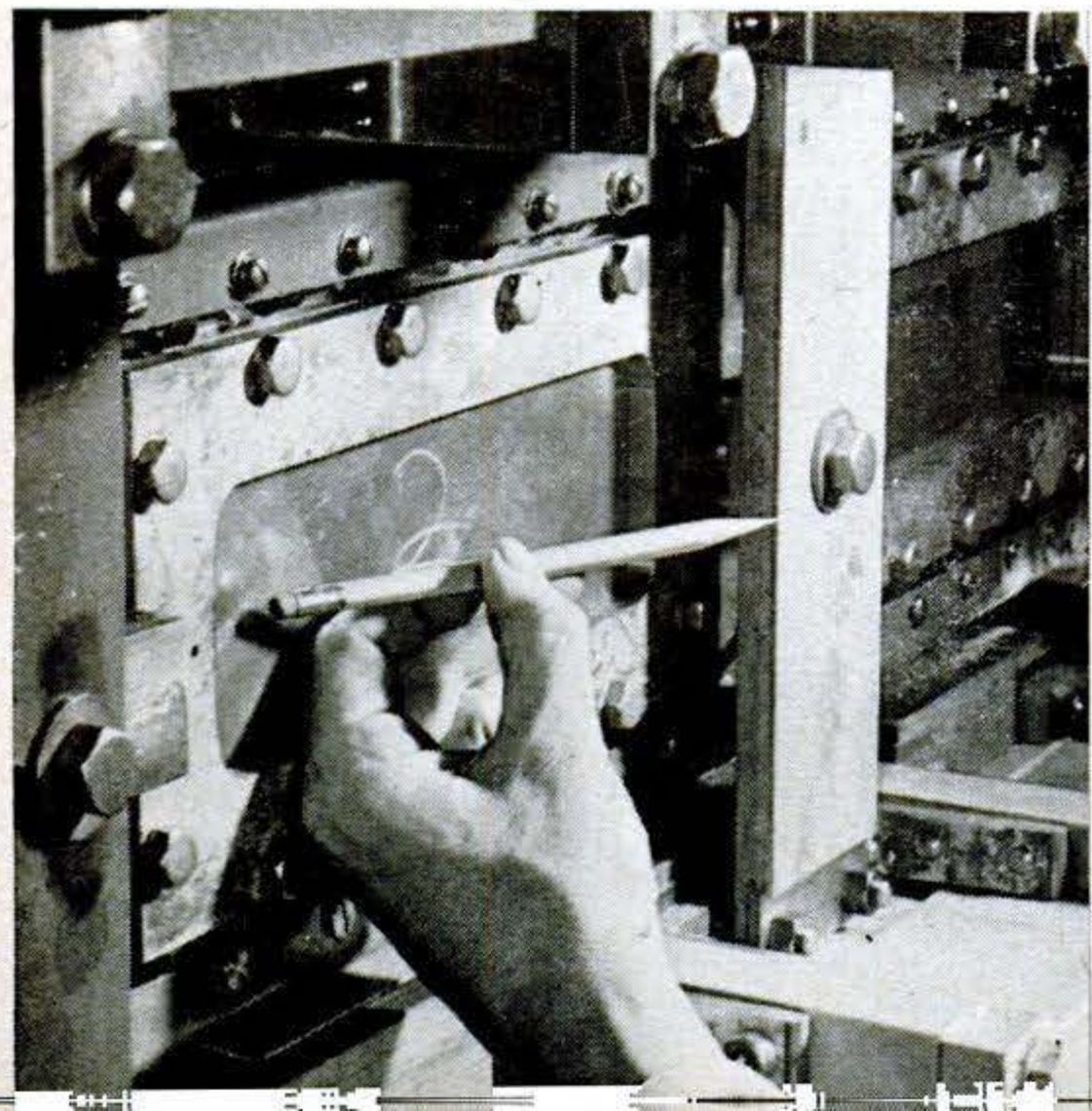
Where things are expected to happen is in a stainless-steel vacuum chamber shaped like a pineapple slice and more than 200 feet around. It looks like an air duct for a heating system. Into it will be shot protons —the cores of hydrogen atoms—from a Van de Graaff generator as large as a tank car.

Then, according to plan:

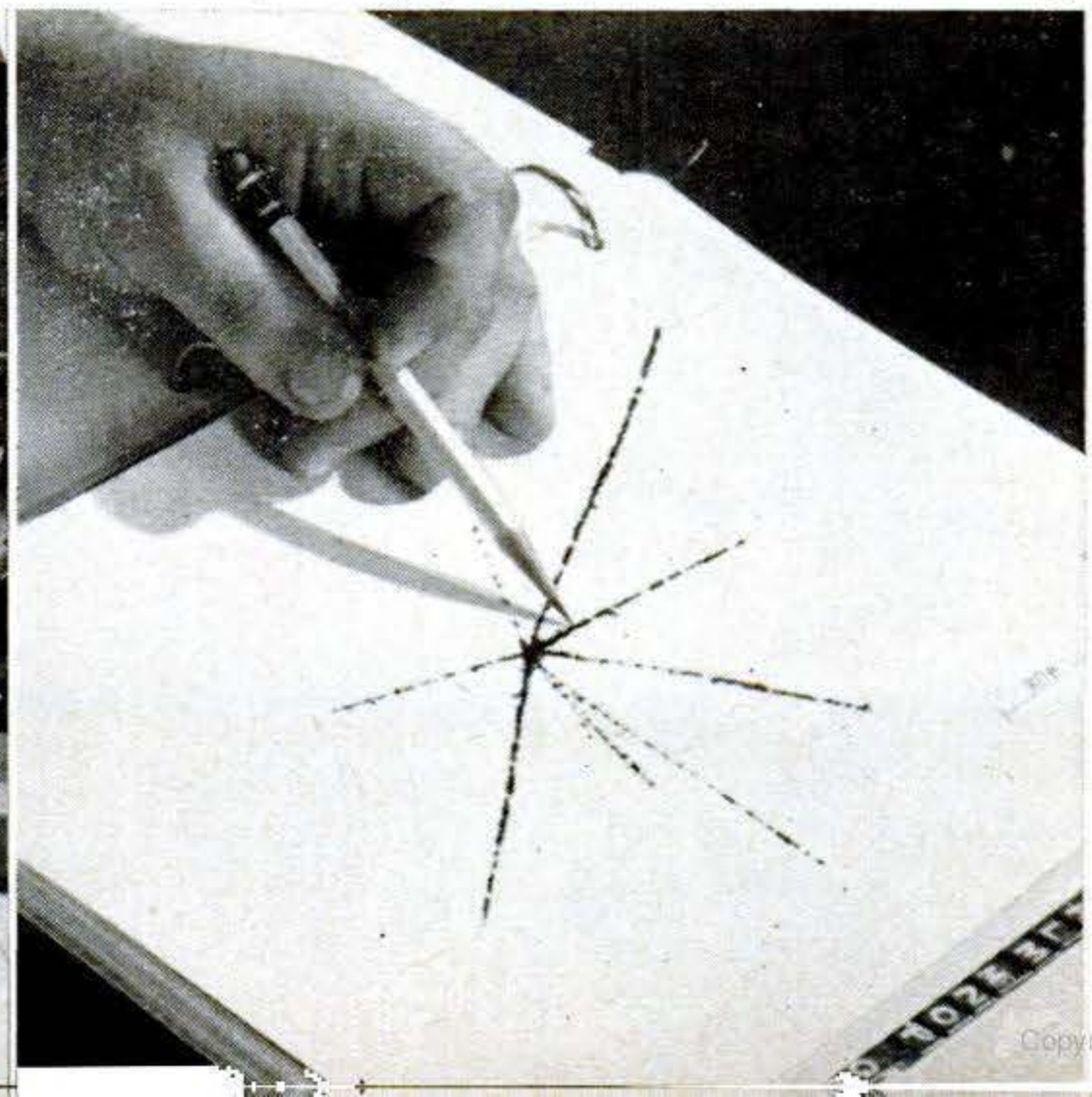
Swinging around and around the curved duct, the protons will get a propelling boost each time they pass an "accelerating transformer." In a second's time they'll go around 3,000,000 times—130,000 miles—and attain an energy as high as 3,000,000,000 electron volts. Then they'll crash head-on into a target, such as a four-inch block of copper or carbon, inserted in one of four straightaway sections. Collision of the proton beam with the target will send atomic particles flying out through thin aluminum windows, where scientists will eagerly capture and observe them.

What new wonders the Cosmotron will reveal not even its builders can predict. But they know that they stand at a long-locked gateway to the secrets of the atom—with the key in their hands.—*Alden P. Armagnac.*

PARTICLES WILL FLY OUT in direction shown by pencil, through thin but solid aluminum windows in portholes like the one below, when billion-volt beam hits target in vacuum chamber.



NO MAN-MADE RADIATION up to now has rivaled power of nature's cosmic rays, which made striking "star" pattern below. Cosmotron's rays may yield pictures as revealing.



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Taxi Is Rolling Workshop

BREAKDOWNS hold no terrors for fares that ride Pierre Alidiere's Paris cab. Beside the driver's seat is a workshop (left above) for fast repairs. Between fares, Alidiere dreams up gadgets to bedeck the hack. Over the windshield is a ventilator made from an old Klaxon covered with a wire salad basket. The extra battery on the floor is charged by fan blades on the roof (right above). It helps operate lights and radio, runs a refrigerator in summer.

Cigarette Lights in Your Hand

THIS French lighter does everything but smoke the cigarette for you. Insert the cigarette, turn the key, withdraw the cigarette —and it's lit without having touched your mouth. The lighter has no wick, uses no fuel. Turning the key rotates a friction wheel against a flint. As the cigarette is pulled out, air enters and the sparking flint particles ignite the tobacco. Rogers Imports, Inc., New York City, sells it.

Land Tug Parks Big Planes

THERE'S no front or rear to this tow tractor that moves off in either direction at a speed of 30 miles per hour. All four wheels steer and two driving seats face in opposite directions. Built by the Euclid Machinery Co., Cleveland, it is Diesel powered through a torque converter and can pull 400,000 pounds. The cab rises hydraulically to give visibility on all sides, or lowers for driving beneath a bomber's wings.

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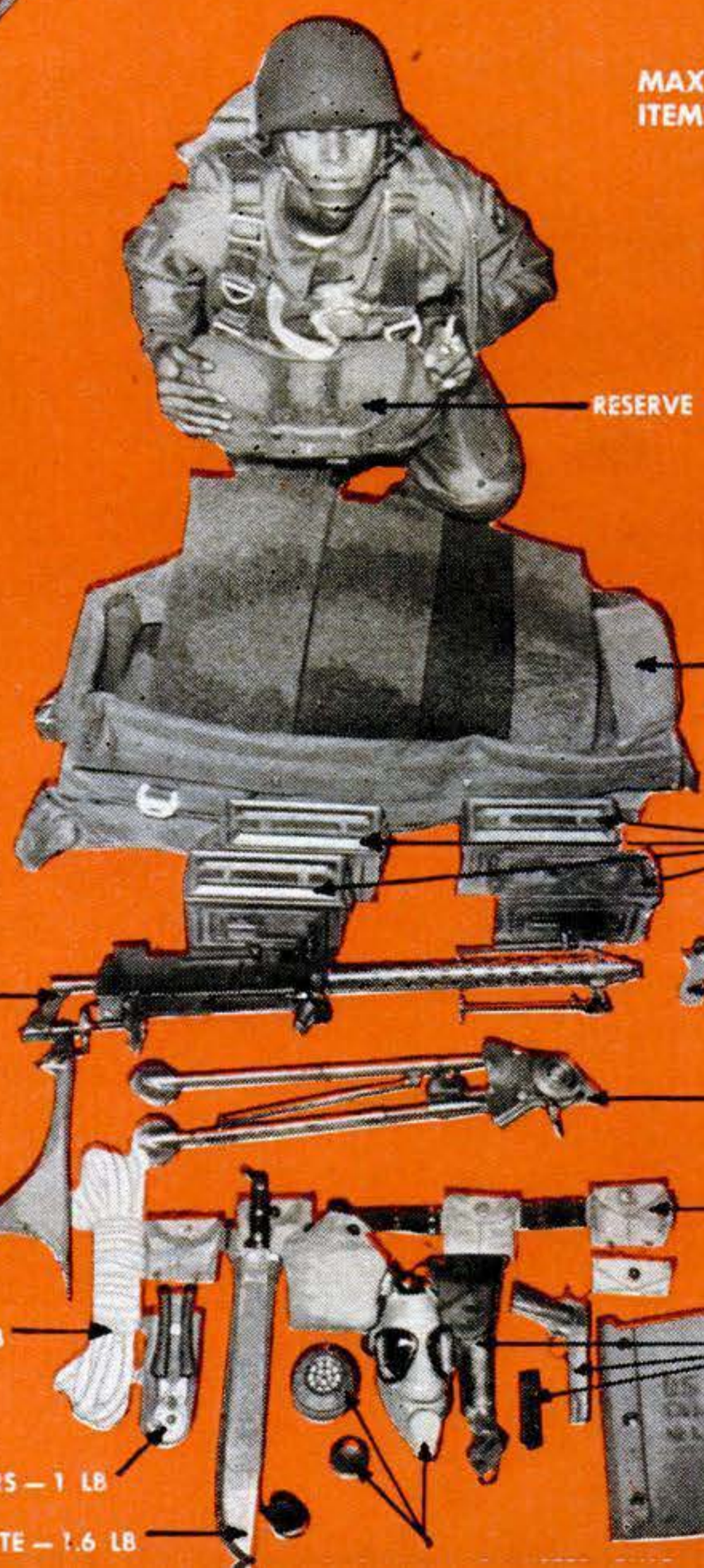
What a Paratrooper Carries When He Jumps

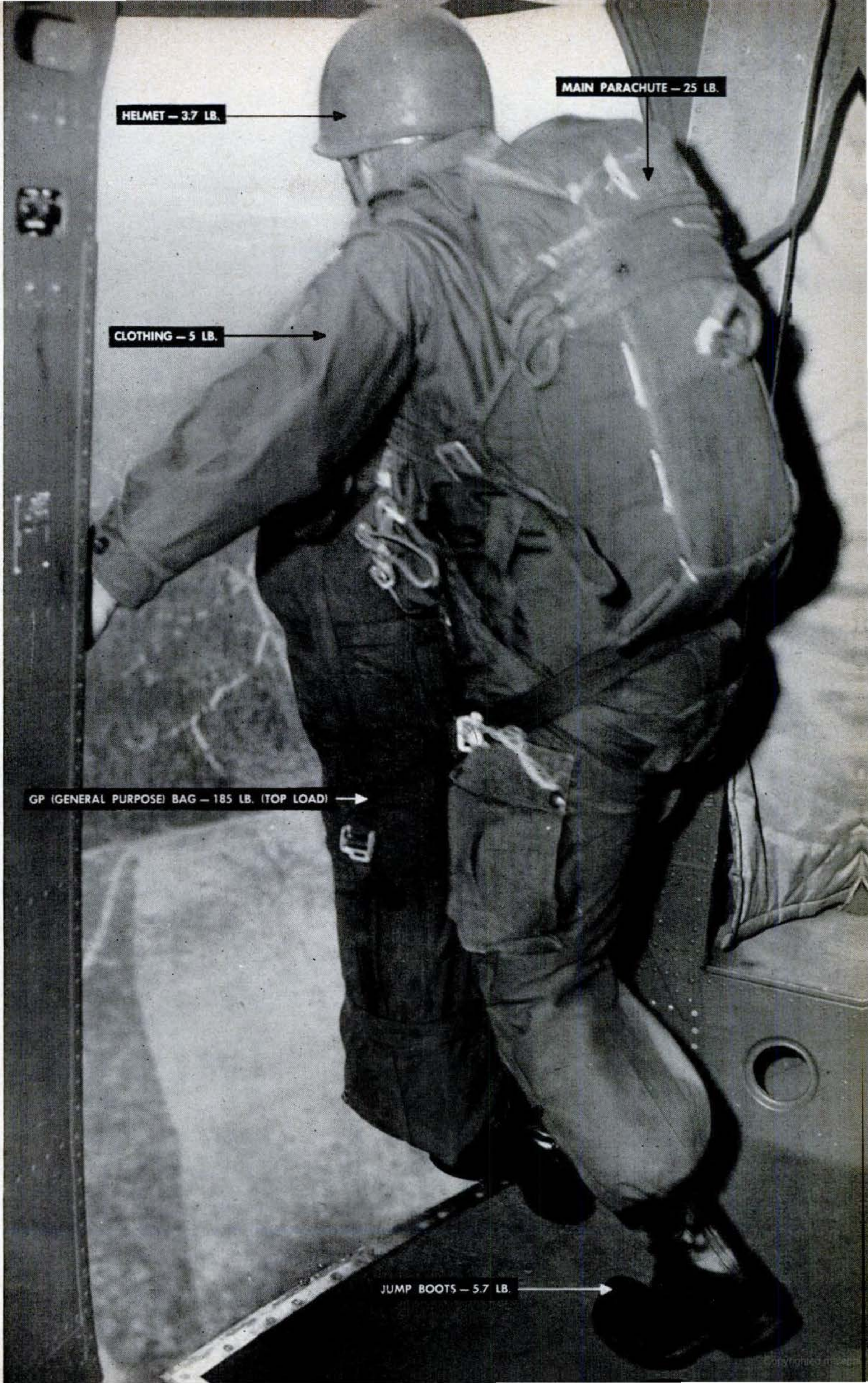
WHEN a U. S. Army paratrooper steps out of a plane door into 1,000 feet of thin air—the height of an average jump—he may weigh as much as 250 pounds more than his flesh and bones do. As shown in these photos, specially posed for PSM by the 82nd Airborne Division, he carries two parachutes, arms and ammunition, food, shelter and spare clothing. It's like jumping with a heavier man strapped to him in front.

Once out the door, he spins earthward, caught by the propeller blast. Suddenly there is a rough, painful jerk. The leg straps bite into his groin and the risers into his shoulders, but he's glad to know his main parachute has opened. Now he must avoid the other men and bundles descending from the plane. A collision might collapse his canopy and let him drop.

He checks the swinging of his parachute to avoid landing on his back or on one side. Soon he casts off his GP (general purpose) bag by its lowering line, ridding himself of 100 to 184 pounds, depending on the weapons in it. Then he brings his feet together, pulls down sharply on the risers and prepares to roll to a safe stop.

PARATROOPER, still 100 feet above the ground, releases his heavy GP bag, which swings safely out of his way.

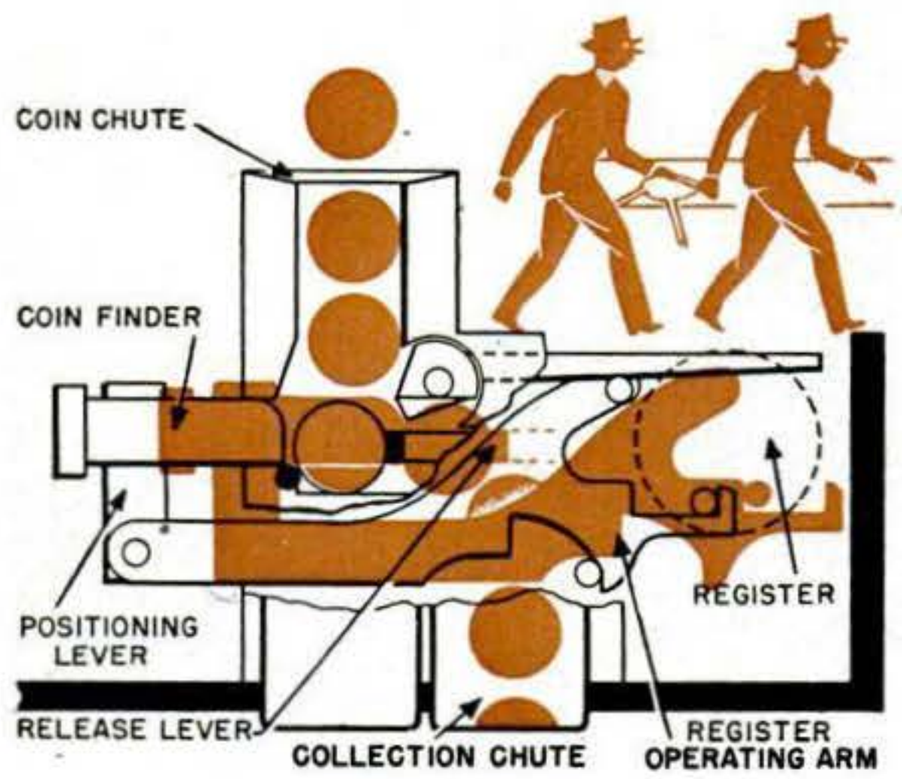



HELMET — 3.7 LB.
MAIN PARACHUTE — 25 LB.
CLOTHING — 5 LB.
GP (GENERAL PURPOSE) BAG — 185 LB. (TOP LOAD)
JUMP BOOTS — 5.7 LB.

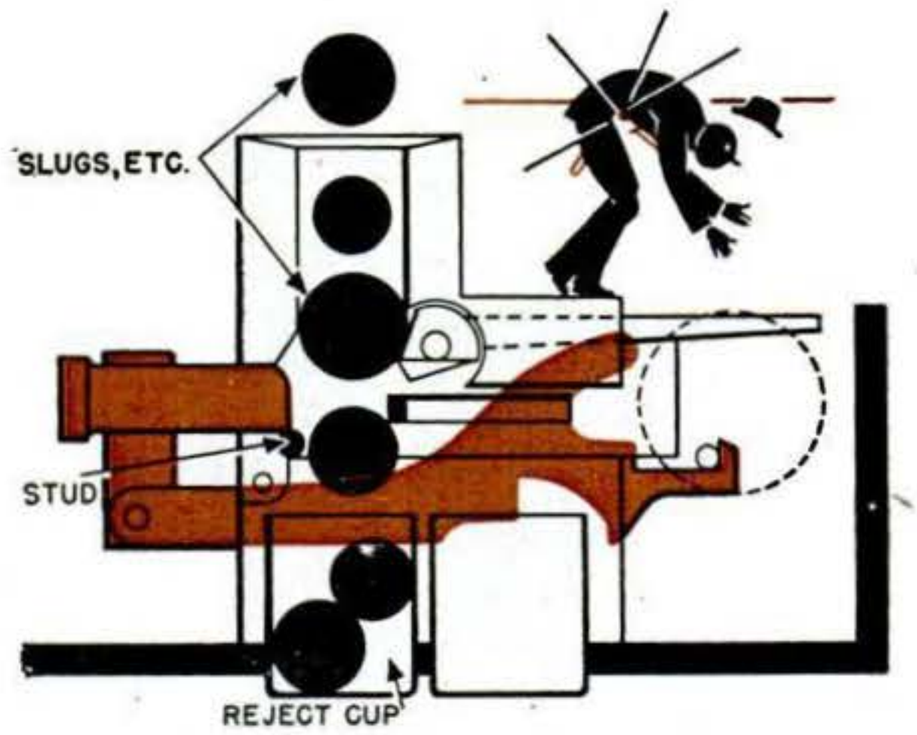
MECHANICS OF LIVING

How a Subway

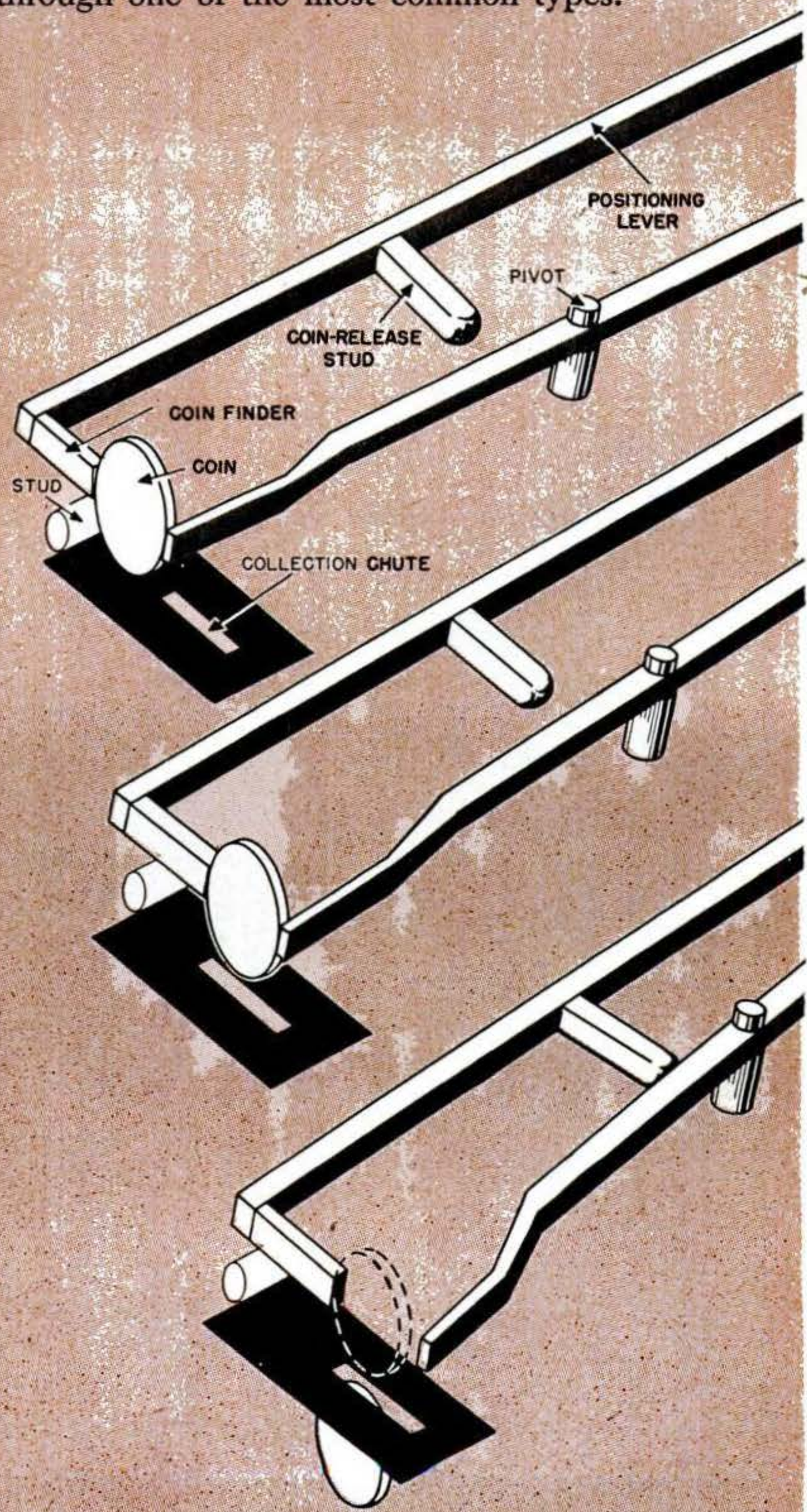
MORE than 4,700,000 people drop coins into the turnstiles of U.S. subway stations every working day. Most of these millions of citizens of New York, Chicago, Philadelphia and Boston—the only American cities that have subways—pay their way to and from business without knowing how the coins make the turnstiles work. Not all subway turnstiles are alike. On these pages we take you along on a coin's two-second trip through one of the most common types.



AN INSIDE VIEW of a coin's trip to the collection chute. As it goes through it moves the operating arm that trips the register. Subway mechanics can adjust the size of the passage it follows to accommodate a nickel, a dime or a token.



IF SOME WISE GUY attempts to use a slug for his fare, this is what happens. If the slug is too big it gets stuck. If it's too small it falls straight through to the reject cup. A slug of exactly the right size will work the average turnstile, but in new models an electronic "eye" will spot it and stop it before it can do the job.



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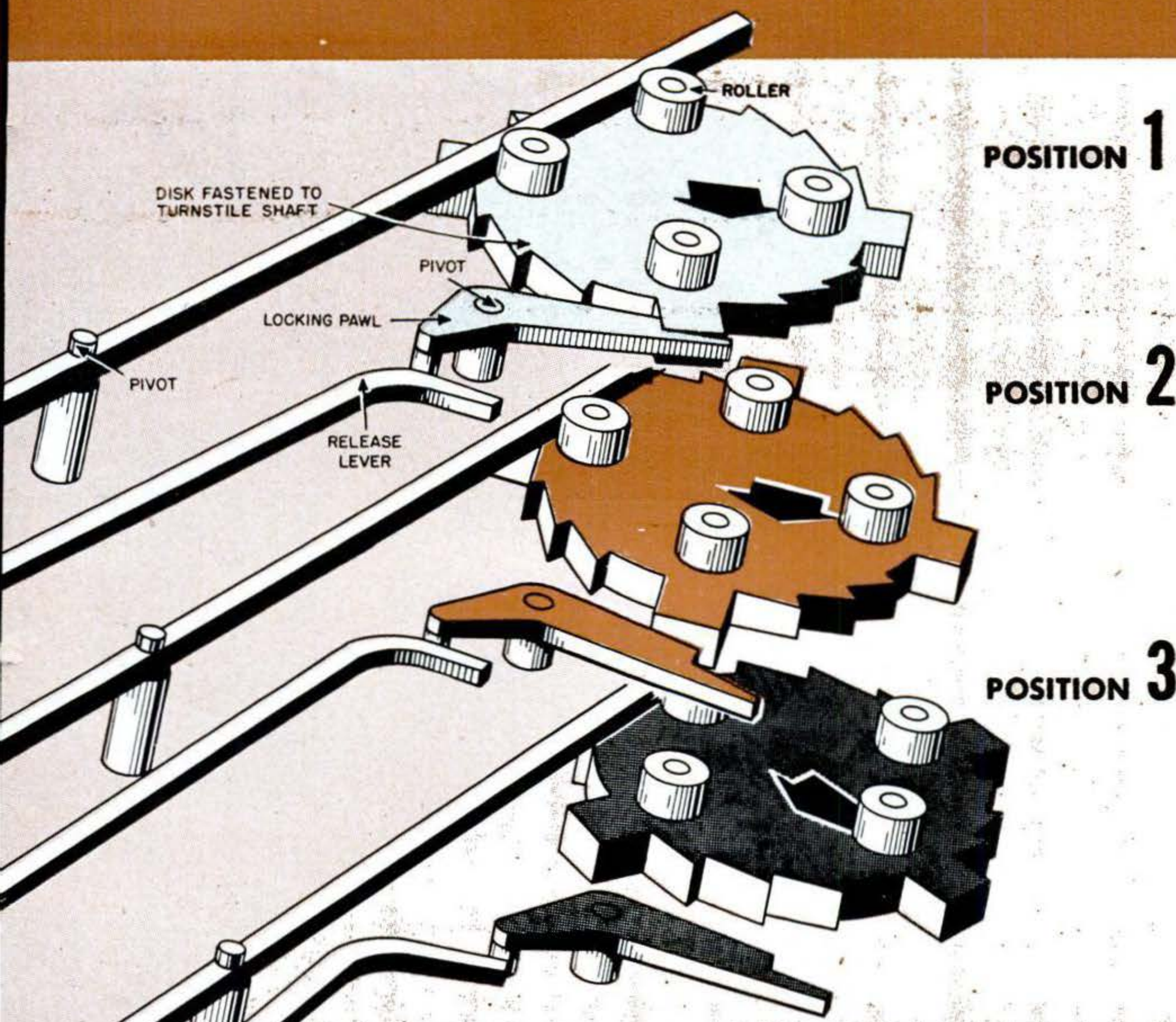
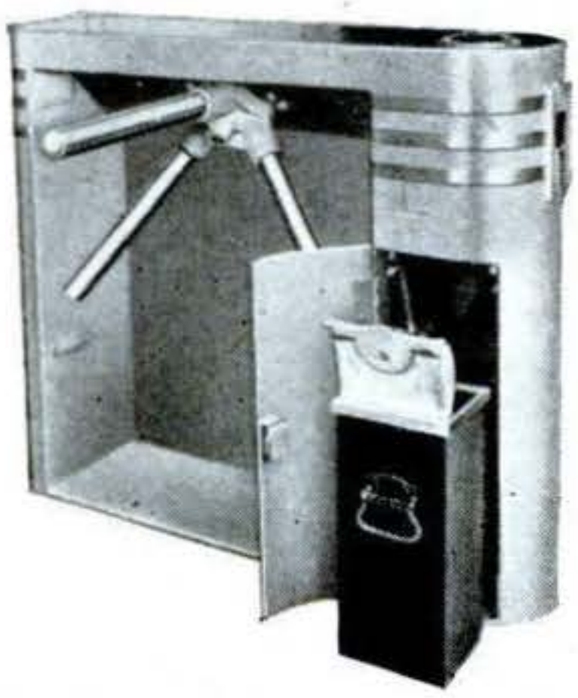
Turnstile Works





WHEN INSTALLED and ready for work, the turnstile mechanism detailed on these pages is tilted 45 degrees. This makes room for more turnstiles. Photo also shows coin box.

1 The coin has dropped through the outside slot to lodge between the stud below the coin finder and one end of the release lever. The turnstile is still locked.

2 The passenger's body is pressing against a turnstile arm, one of three attached to the disk. This causes the rollers on the disk to move the rear end of the positioning lever to the left. Its front end, the coin finder, simultaneously moves right, pushing the coin ahead of it. The coin in turn pushes one end of the release lever, causing the other end to nudge the locking pawl and release the disk. The disk then swings 90 degrees in the direction the arrow indicates as the passenger goes through.

3 At the end of the disk's turn, its rollers have pushed the rear end of the positioning lever as far left as it will go. The coin-release stud has come in contact with the release lever and has moved it far enough right to let coin drop into collection chute and register the fare. Springs then snap both levers back to Position 1.

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Wilbur Shaw Says:

The Chevy

By Wilbur Shaw

I SLID behind the wheel of a 1952 Chevrolet on the Indianapolis Speedway remarking to myself that I was deliberately inviting trouble. Anyone who draws a bead on the world's most popular automobile is bound to get some protests from indignant owners. But here goes my neck out.

No car is perfect. The Chevrolet isn't. But its credits certainly far outweigh its debits.

The car I chose for my Report from the Driver's Seat was a Bel Air model equipped with a Powerglide (torque-converter) auto-transmission. The Bel Air is Chevrolet's hard-top convertible.

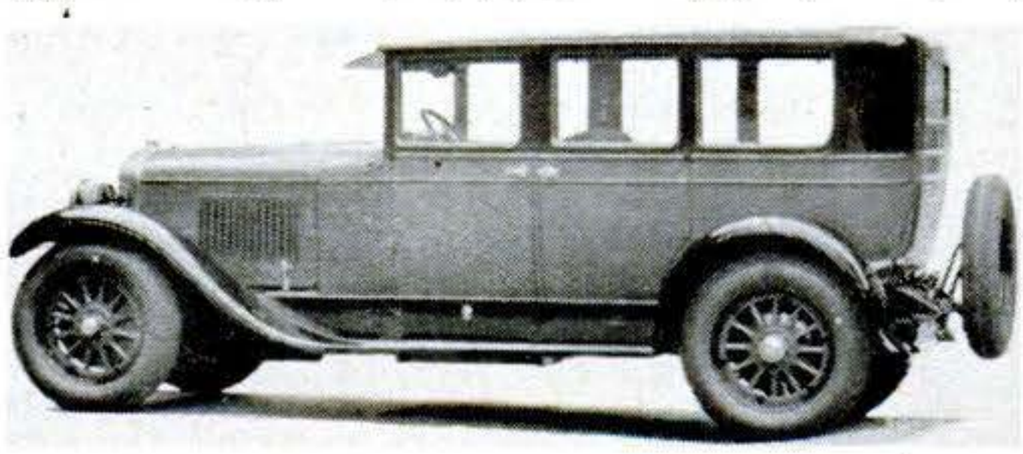
The small cars keep getting bigger and bigger. This job had a lot more space in it than a 1927 Cadillac, one of the big cars of a quarter of a century ago.

The hip room in the front seat, for instance, is better than 60 inches. In the 1927 Cadillac model 314 it was only 44 inches. My curiosity about the old Cadillac, inspired by the fact that several automobile companies are celebrating anniversaries this year, turned up some other comparisons with the Chevrolet. I'll mention a few as we go along.

Here's what I said on my recording machine as I prepared to put the car through its paces:

This year's Chevrolet . . . like most of the other cars . . . is substantially the same car that it was last year . . . due to the defense effort. The front end is renovated . . . the engine mountings are changed . . . and the Powerglide models have an automatic choke. You won't have to wrestle with the choke knob on cold mornings . . .

The seat is comfortable, the visibility is



1927 CADILLAC

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Is a Big Car Now!

Comparisons with a "big" car of 25 years ago show that the "little" cars of today are roomier, more powerful.

splendid . . . but the position of the rear-vision mirror doesn't give me much of a view of the road behind.

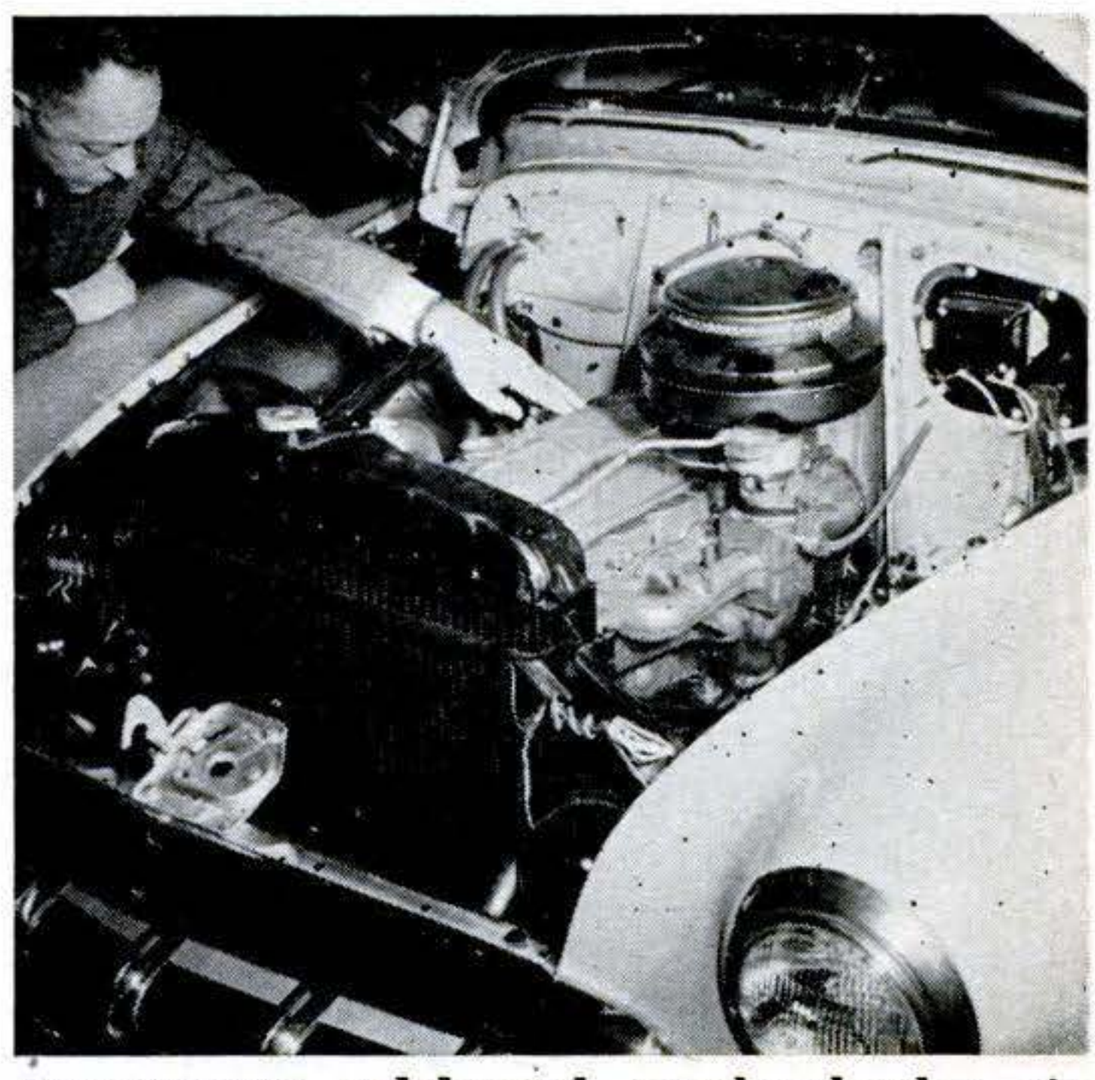
Lowering the mirror might help. But for my own driving, I'd want an outside mirror.

I fired up. Under the hood were 105 horses —10 more than the 1927 Cadillac had. The Chevvy's six-cylinder overhead-valve engine is famous. In big-production automobiles, Chevrolet pioneered this design.

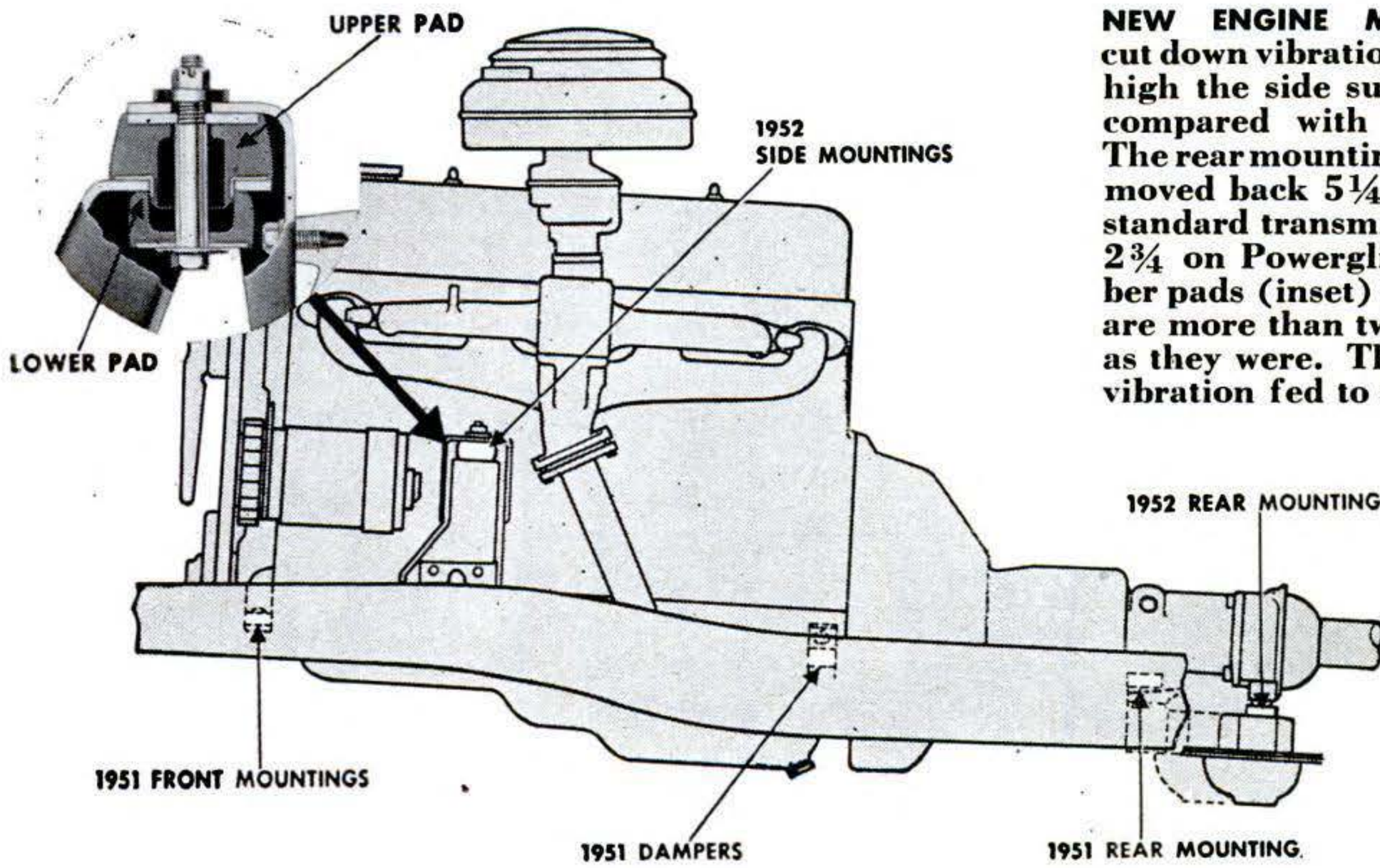
I warmed up, stepped on the throttle and led the car around the Speedway.

Roadability was excellent. She stayed where you put her. At hard throttle I touched 75 miles an hour, then 80 and finally 85. That was tops.

It should have done better. The Johnson Chevrolet agency in Indianapolis, which had supplied the car, said the top speed, not allowing for speedometer error, should be between 95 and 100. I believe it would have



CHEVROLET'S celebrated overhead-valve six now has an improved carburetor for better starting and idle running. With Powerglide, a thermostat controls an automatic choke.



NEW ENGINE MOUNTINGS cut down vibration. See how high the side supports are compared with last year. The rear mounting has been moved back 5¼ inches on standard transmissions and 2¾ on Powerglides. Rubber pads (inset) on the side are more than twice as soft as they were. This reduces vibration fed to the frame.

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FACTS ON '52 CHEVROLET

Model: Two-door Bel Air.

Engine: 6-cyl. overhead-valve; 105 hp. at 3,600 r.p.m.; car weight per hp., 33.3 lb.; bore and stroke, 3 9/16" by 3 15/16"; compression ratio, 6.7:1; piston displacement, 235.5 cu. in.

Engine piston travel: (in feet per car mile at 20 m.p.h.) 1,755 (assuming a 1:1 ratio in torque converter).

Crankshaft bearing surface: 38.36 sq. in.

Torque: 193 lb.-ft. at 2,000 r.p.m.

Transmission: Powerglide (optional).

Rear-axle ratio: 3.55:1.

Steering ratio: 19.4:1.

Radius of turning circle: 18.5 ft.

Effective brake-lining area: 158 sq. in.

Springs: front, coil; rear, semi-elliptic.

Weight and outside dimensions: 3,495 lb.; height, 64 1/16"; over-all length with bumpers and guards, 198⅛"; width, 74¾"; wheelbase, 115"; overhang, front 34 5/16", rear 48 13/16", tread, front 56 11/16", rear 58¾".

Inside dimensions: seat-cushion width, front 60⅛", rear 52½"; leg room, front 42⅝", rear 35¼"; headroom, front 34⅛", rear 33⅝"; seat height, front 13⅝", rear 12"; vertical distance, steering wheel to seat cushion, with seat in rear position, 5¾"; front-seat adjustment, horizontal 4⅜", vertical ½".

Tire size: 6.70 by 15.

done better if it had more miles on it. This one was new.

I let the speed drift down to an indicated 60 and jammed on the brakes.

This is hard braking . . . so hard that the tires squeal . . . she stops nicely . . . there's no sway or grab.

The distance, not counting reaction time, was 148½ feet. That compares with 185 feet specified by the National Safety Council for stopping on dry pavement from 60.

I decided to see what the Chevrolet torque-converter transmission would do on acceleration. I also wanted to concentrate on the vibration. The new engine mountings were designed to reduce vibration caused by torque—the rotation-caused twisting of the engine in its cradle.

Vibration Is Low

I'll start in Drive range from a dead stop . . . there's 30 miles an hour . . . 45 . . . 55 . . . 60, and the stopwatch says 19.1 seconds . . . That's all right for an engine toting 33 pounds for each horsepower . . . a rear-axle ratio of 3.55 to 1 . . . and a simple torque-converter transmission.

Next I started in Low range and shifted to Drive. Shifting at 20 miles an hour got me to 60 in 19 seconds. Shifting at 30 reduced that to 18 seconds, and at 40, to 16 seconds.

Vibration was low. It definitely had been reduced from what it was last year.

In 1951, the engine and transmission had five points of suspension. The supports were at the base of the engine block. There were two mountings in front, two at the rear of the block and one on the transmission. At each support point a single rubber cushion insulated the engine block from the frame.

This year Chevrolet changed to a three-point mounting. Support points are at the middle instead of at the base of the block. So the engine's center of gravity is lower. That reduces the rolling motion. The front supports are gone. There are two at the sides and one on the transmission.

Two rubber pads instead of one at the side support points insulate engine vibration from the frame. When the weight of the engine is on the frame, a top pad is compressed. When the car hits a bump and the engine yanks upward in rebound, a lower pad compresses.

The net result of remounting the engine is a softer cradle that translates torque into mild up-and-down instead of rotary motion.

I was curious as to what Powerglide would do on acceleration in the middle speed ranges. Accelerating to 50, I let the car drift back to 35 so the engine would be unloaded, and then opened the throttle. It took just 3.8 seconds for the needle to indicate 45. That was significant. It was proof that at cruising speeds there was little slippage in the fluid coupling (which a torque converter becomes at low engine load). A minimum of slippage means a minimum of wasted fuel.

What Powerglide Does

There are some misconceptions about these different brands of automatic transmissions I'd like to clear up.

The various companies choose a particular automatic transmission for particular reasons. Chevrolet, along with Buick, has the least complicated. In the Drive range, accelerating at low car speed, the car is propelled by a torque converter, pure and simple. It has

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THE PANEL IS UNCHANGED. Driver's entrance room in the Bel Air is 25 by 40½ inches. This compares with the Ford Victoria's 32 by 43 and the Plymouth two-door's 30 by 44.

no gears assisting acceleration when the light turns green.

Other companies choose an automatic transmission for snap. Hydra-Matic, for instance, supplies a faster take-off and, I might add, usually more miles to the gallon.

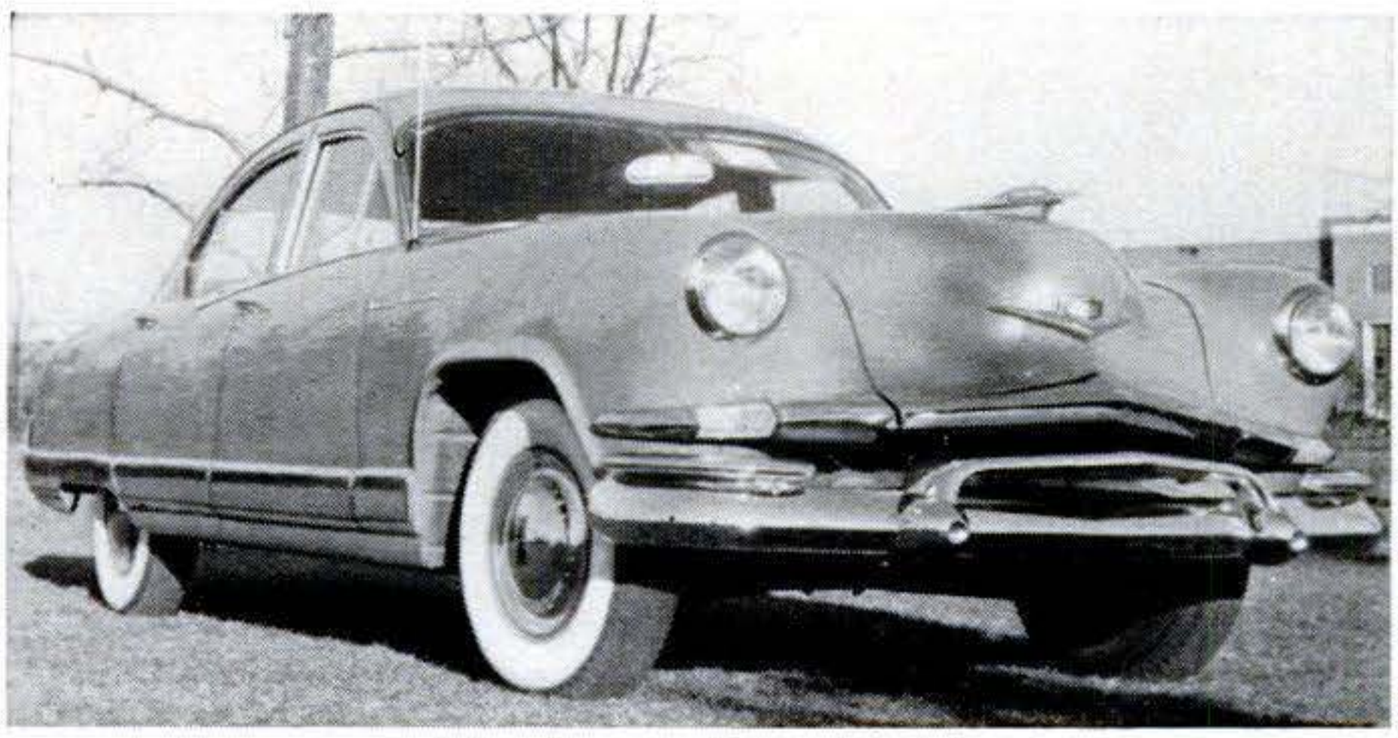
But Hydra-Matics pulsate as the gears change in acceleration. You can feel the car step up its *rate* of acceleration. You can feel the same thing in most torque converters equipped with a supplemental gear in the Drive range. As the car gains speed and the gear rolls out of the power train, there's a thump. You can also feel it in torque converters that "lock up" as the car gains speed.

These variations in transmission design afford certain advantages. The assisting gear used with some torque converters boosts the rate of acceleration from a standing start. The lock-up gives the engine a direct mechanical connection with the rear wheels. Result: better acceleration at cruise, better gas economy.

Chevrolet (and Buick) chose the torque converter without frills or furbelows to achieve the smoothest acceleration known to the industry. Chevrolet's Powerglide is well-named. You get no thumps, no pulsations. But with Powerglide, Chevrolet had to reduce its rear-axle ratio to get gas economy and then boost its horsepower to get performance. It's that simple.

I took another turn around the track. Yes, I ruminated, the small cars of today are a lot better than the big cars of yesteryear. Here was a car with a 6.7 to 1 compression ratio. The 1927 Caddy had only 4 to 1, with consequent low performance and bad gas economy. The 1952 Chevvy, with a 115-inch wheelbase and a weight under 3,500 pounds, was more capacious than that old V-8 Caddy of 132 inches and 4,270 pounds. END

Wilbur Shaw Lines Up '52 Kaiser for Next Month



THAT one-piece windshield is the main change you can see in the 1952 Kaiser (left). In addition, it has switch-key starting, an optional Dual-Range Hydra-Matic transmission and several styling refinements. **Wilbur Shaw will report on this car in the May issue of PSM.**

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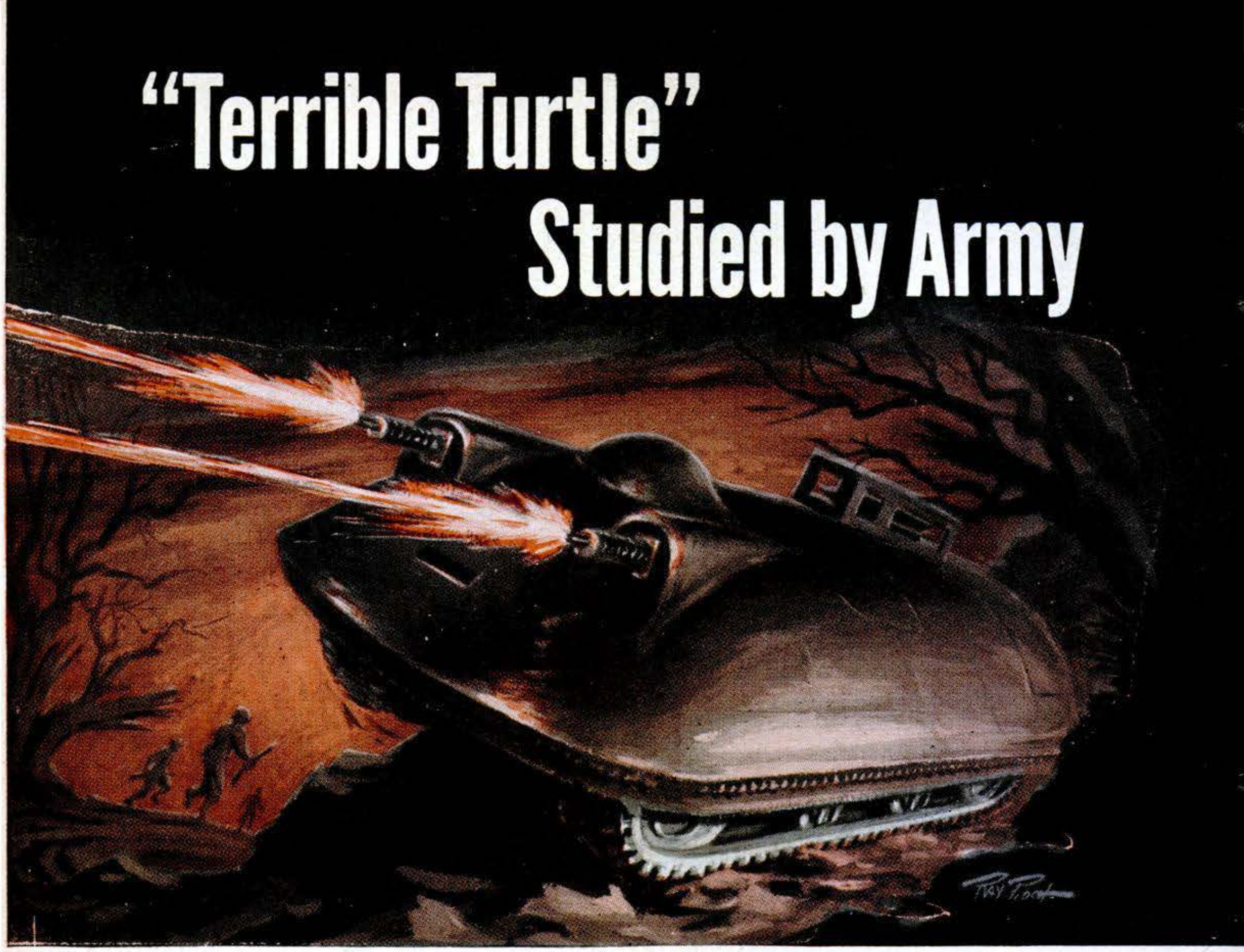
"Terrible Turtle" Studied by Army



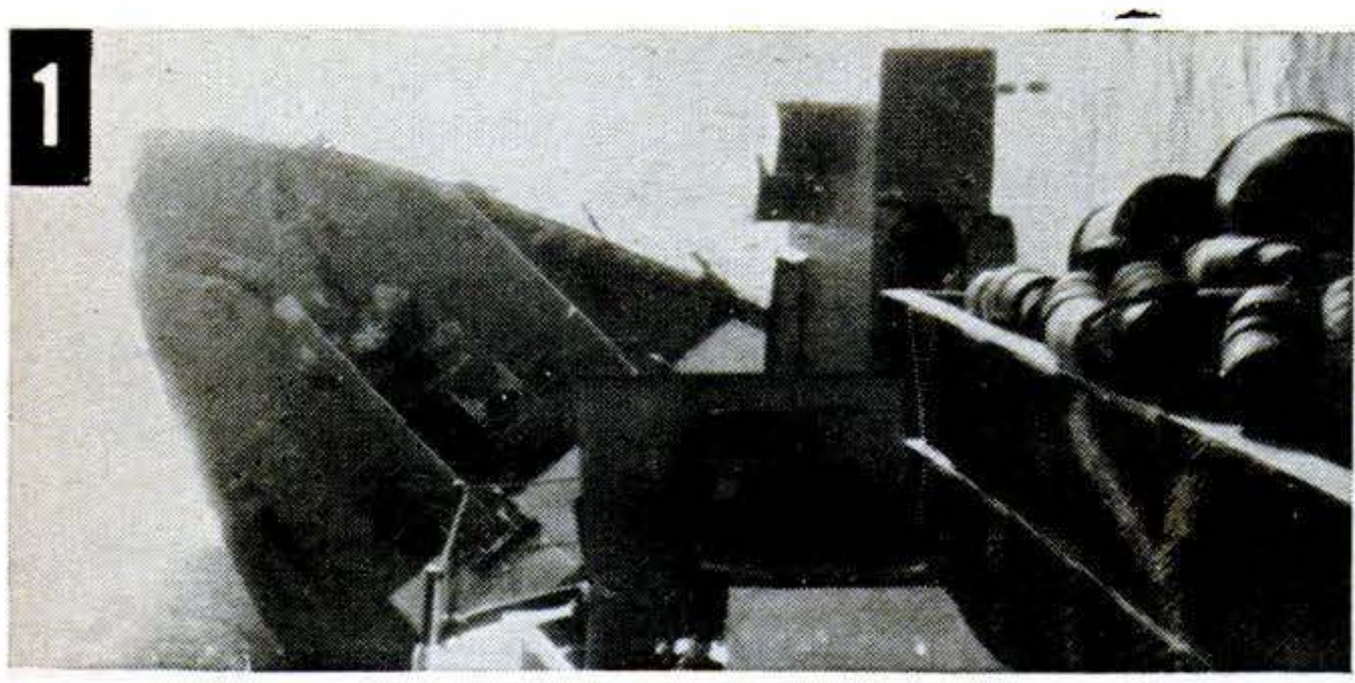
ITS mighty firepower could make this one-man midget tank the scourge of battlefield or beachhead. It is now being considered by experts of Army Ordnance.

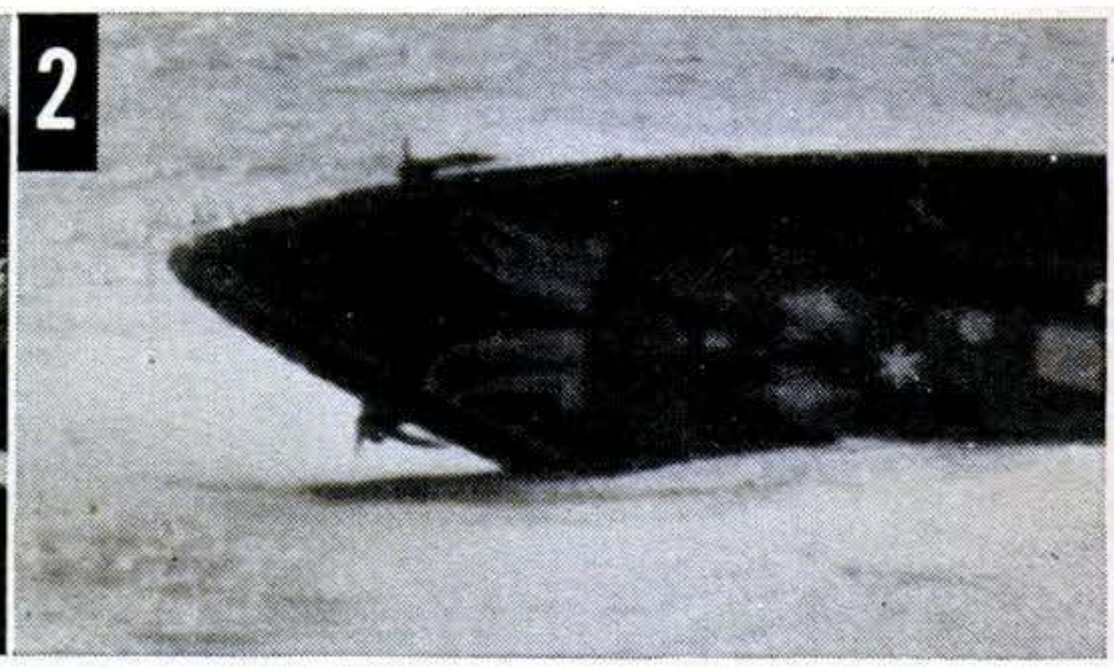
Scurrying low over the ground at 30 miles an hour, its lone commando operator would trigger two fire-spitting .30-caliber machine guns. Above him as he lay on his stomach peering through front- and rear-view periscopes, would be a rocket launcher with 13 packages of explosive. And his steel turtle shell, designed to deflect any enemy missiles, would be rimmed around with 650 ports holding standard shotgun shells that he

Bow Blasted Off, Destroyer Steams Home

THE USS *Small* struck a mine off Korea recently—and stayed afloat to bring back the story of her adventure in the dramatic photo sequence below.

1. With the bow loose and starting to fall off, threatening the rest of the ship, the





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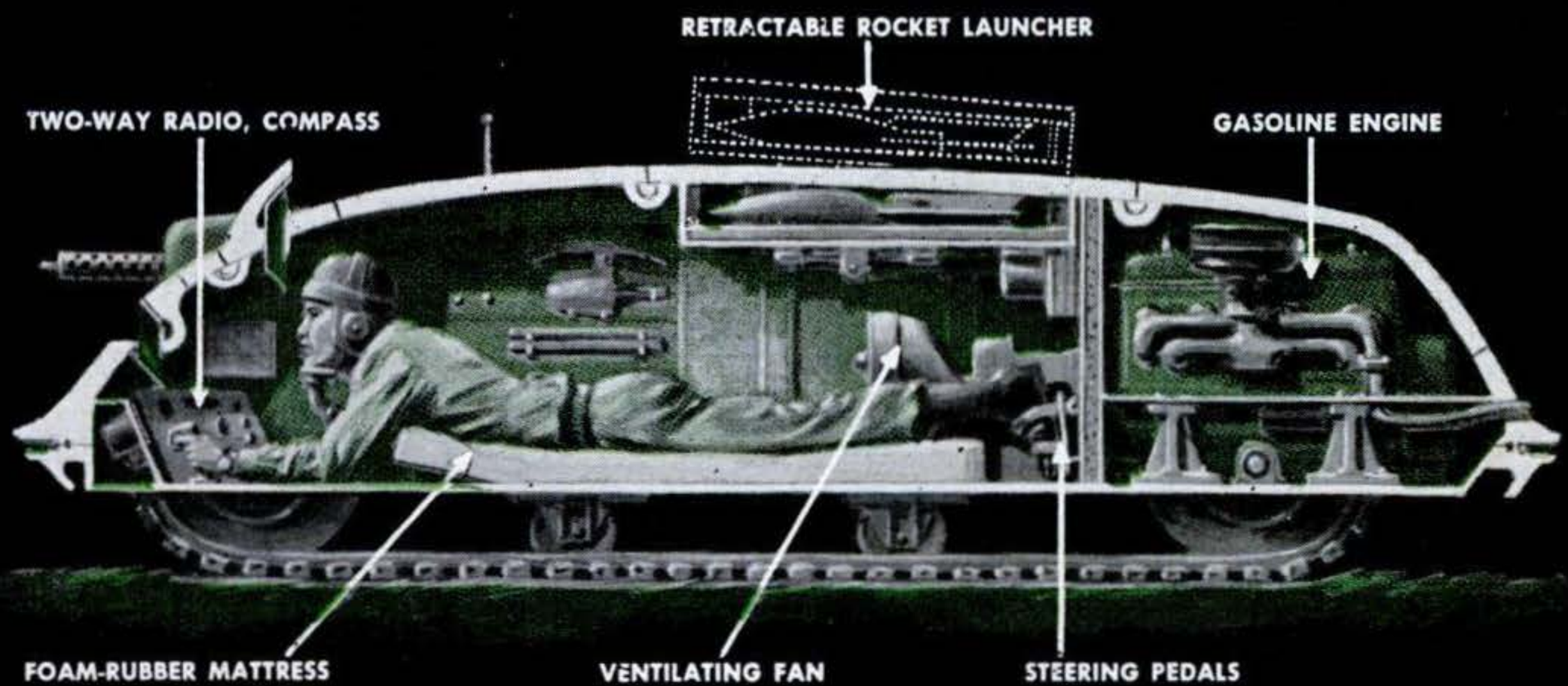
A tiny tank that is armored and armed for one-man assaults, it can't turn turtle.

FRONT VIEW SHOWS PILOT'S CHIN REST. CURVED ABOVE HIM ARE ROCKETS.



could fire electrically in all directions.

And if that isn't enough, says the Turtle's inventor, Les G. Scherer of Los Angeles, we could build in flame throwers.

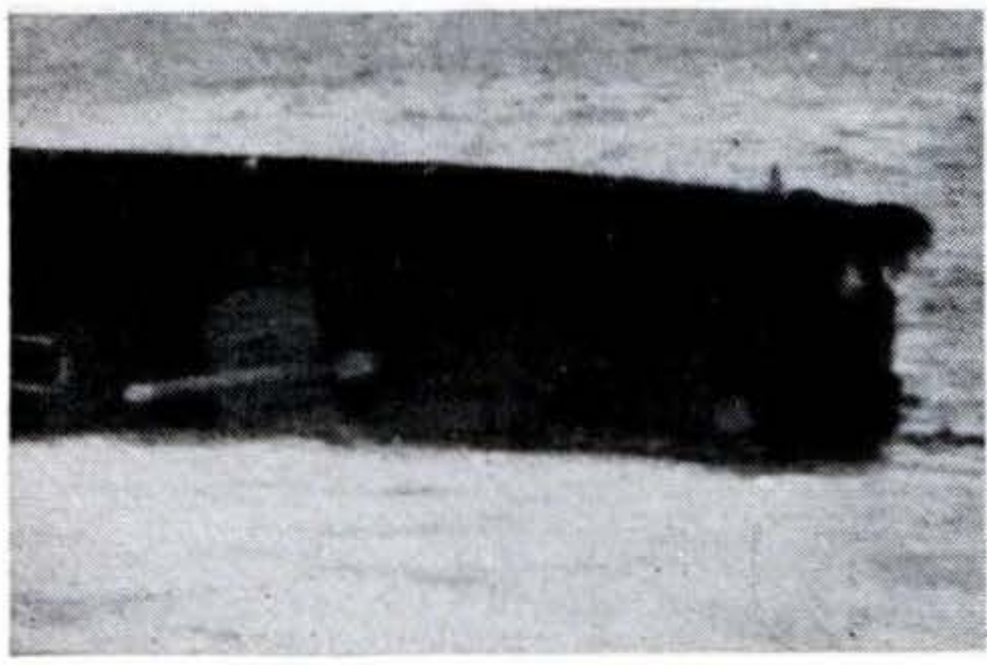
The tiny tank, weighing about 7,000 pounds, would be 9½ feet long, 2½ feet high and about 5½ feet wide. One feature that the inventor says interests the Army is a center of gravity less than 1½ feet off the ground—that would make the turtle almost impossible to turn over. Also, he claims, it would be able to climb any hills a big tank can and turn in its own length.—*David O. Woodbury, La Canada, Calif.*

---

captain checked the watertight bulkhead just astern of the break for possible leaks. Finding none, he stopped his ship and then backed away.

2. His trick worked. The bow broke completely free and is shown floating on its side.

3. The bulkhead held out the sea as the bow-shorn *Small* backed slowly toward Japan. There a short temporary bow was fitted on the destroyer so it could make the trip back to the United States for permanent repairs.



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Will You Pay

Yes, say the promoters of three ways to collect from you in your living room. And they say you'll like it, too.

By Hartley E. Howe

REMEMBER the lady wrestlers and second-rate movies, vintage 1930, that were the only things you could see on your brand-new TV set a few years back? Now real entertainment shines off the cathode-ray tube—the world's most famous singers, dancers and actors in smooth musical programs and plays. But you ain't seen nothin' yet.

Coming soon—delivered to you regularly in your own living room—may be: complete Broadway shows direct from their playhouses; first-class *new* movies starring Hollywood's best; your pick of the big-time sports events. The inventors have come up with ways of sending them to you COD.

Pay-as-you-look TV wouldn't be a substitute for regular television, but it would give you a lot of things you can't get much of now. A good movie, for example, costs around $1,000,000 to make. Corporations willing to lay out this kind of dough for a few minutes' praise of their products are few. That's why television movies are mostly grade C, and even these are ancient.

But suppose a picture like "Father of the Bride" were on TV. A show that good can count on more than a million sets tuned in. If each set owner kicked in with a dollar, the producers would be in the black in a single evening—and still have a big theater audience to exploit.

Or maybe you'd like to see "South Pacific." Instead of waiting months for tickets, you could just flick your channel selector knob. Rodgers and Hammerstein shouldn't object to keyhole peepers who paid cash.

TV Hurts Gate of Big Events

First-rate sporting events—like championship fights and big football games—are becoming rarer on television. TV cuts the gate so much that promoters won't let the cameras in. But the welcome mat would be out if the home audience paid.

Surprisingly, pay-as-you-look TV should also benefit high-class cultural entertainment that draws only a limited audience. A symphony concert may cost just a fraction as much as a movie to produce, but it gets proportionately fewer viewers, and adver-

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tisers find it unprofitable. A small paying audience, however, could support high-brow music, dancing and lectures that now are rarely seen on TV.

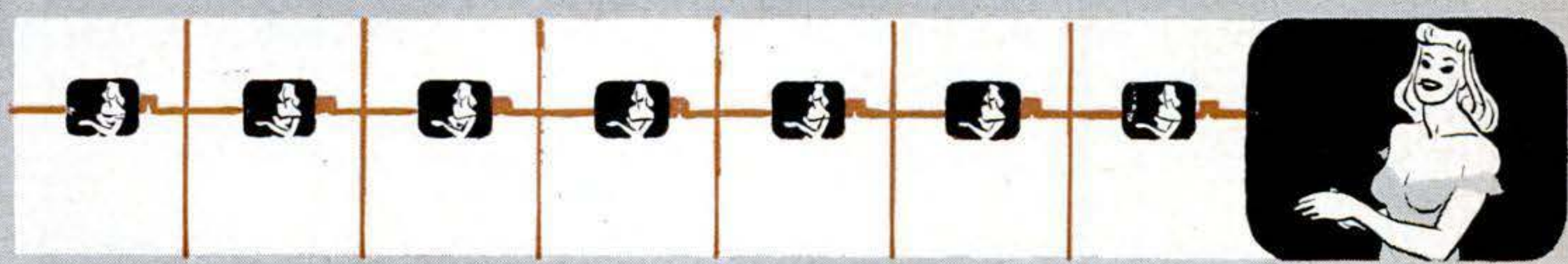
It Does Work

Paid television has had only one test so far. In Chicago, 300 set owners were offered three movies a day for a dollar apiece in a trial of Zenith's Phonevision. The typical family tuned in, and paid for, 1.73 films a week—four times the average American movie attendance. Another test—of Paramount's Telemeter this time—will be held at Palm Springs, Calif., which is isolated by mountains from all present television. Telemeter will install coin boxes on receivers in a sample group of homes. Paid programs will be piped to the sets of test subscribers over a special cable.

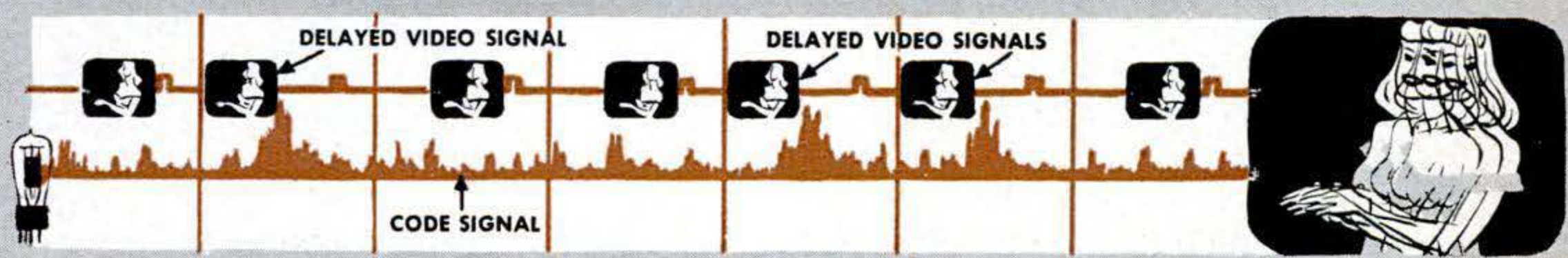
How would pay-as-you-look TV work? It would depend partly on whether you subscribed to Zenith's Phonevision, Paramount's Telemeter or Skiatron's Subscriber Vision. All are alike, however, in principle: the televised picture is blurred on ordinary receivers. To clear it up you must buy their service. This means either buying or renting a decoder box that is plugged into your set. In addition you buy the information that adjusts the decoder for a specific program or a given length of time. This is necessary because the codes are changed frequently to keep the electronics sharks from figuring

for TV Shows?

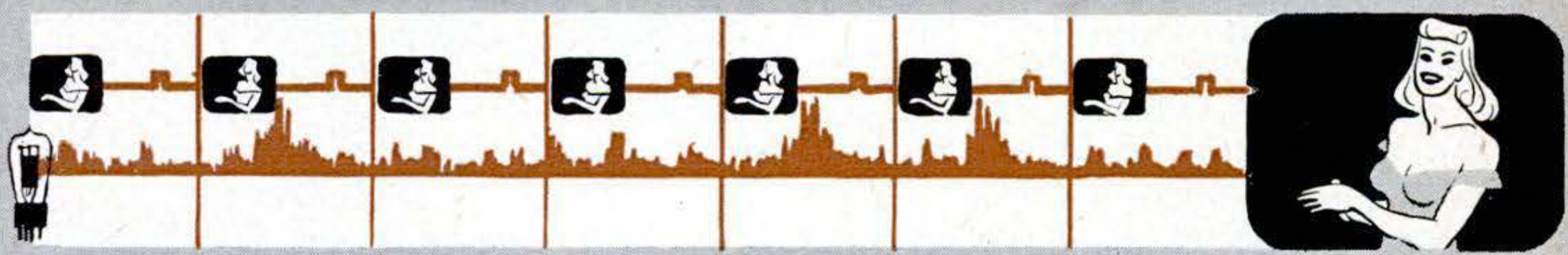
How a TV Picture Is Scrambled—and Unscrambled . . .



NORMAL PICTURE. You see single image on your screen because video signal (tiny screen in pictogram above), which varies electron beam to make light and dark on picture tube, arrives in time with sync signal (pip on line) that starts beam sweeping across tube face.



SCRAMBLED PICTURE. If some video signals are delayed and arrive after beam has started across tube, then picture shifts to one side. When done for random signals, chosen by peaks of irregular output of code generator, picture jumps back and forth rapidly, blurs.



UNSCRAMBLED PICTURE. When decoder delays all normal video signals so they arrive as late as others, then single image shows on screen and is recentered automatically. Another coding method keeps video signal on time, makes sync pulses late or early to blur picture.

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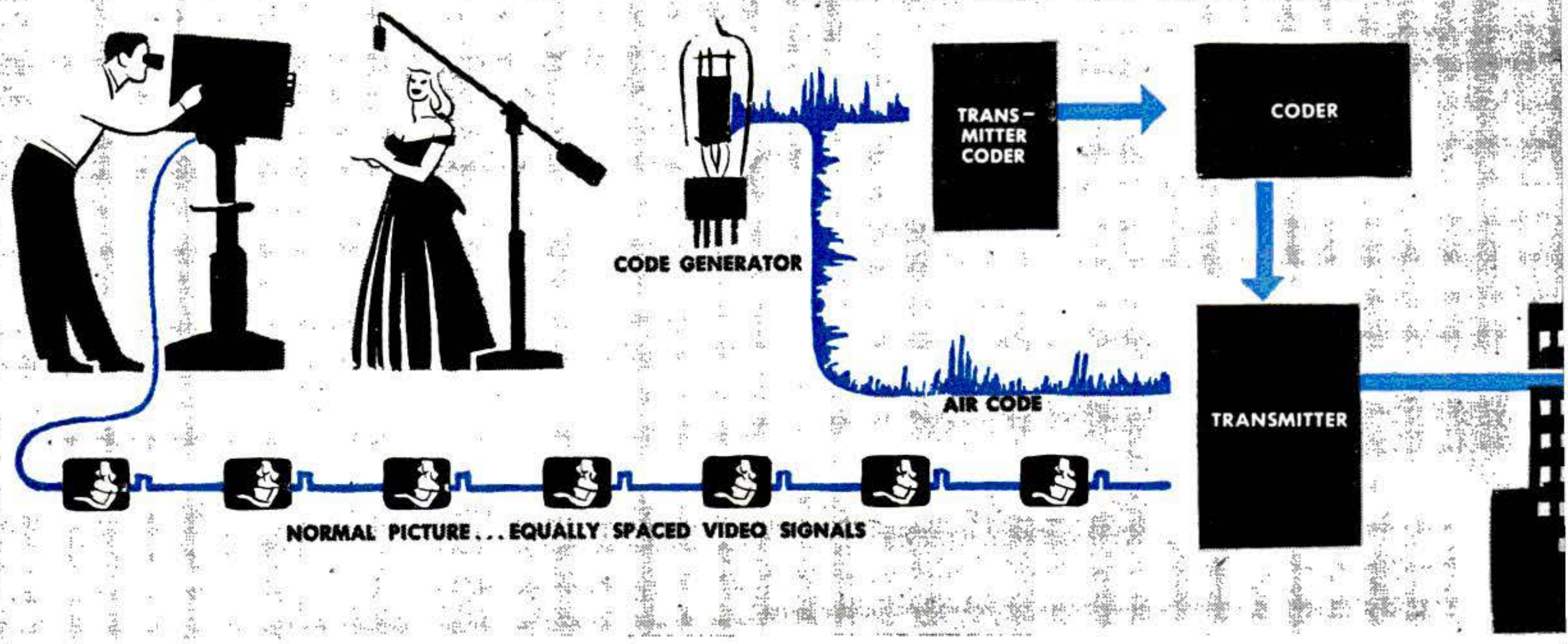
How Pay-as-You-Look TV Works...

There are several methods of charging for television shows, all similar in operation. One sketched here would scramble normal picture from camera, then transmit scrambled version along with code. To get a clear picture, set owner would call switchboard, get special dial settings for his code translator. He could then adjust the decoder to clarify picture.



them out and building their own decoders.

The three systems agree, too, in the general way the picture is jumbled: "tampering with the time relationship between the synchronizer and the video information," as Telemeter puts it. That's as far as Telemeter will commit itself now. In Subscriber Vision, one of four different horizontal driving pulses is chosen according to a coding pattern at the camera. One pulse is normal, the others start a little earlier or a little later. Each kind of pulse is used for one "field" (half a "frame").

Picture Jumps

Varying the camera's pulses varies the sync signal that times the driving pulses in the receiver. The result is that the picture shifts slightly to one side or the other of normal for a full field. Four slightly offset pictures are seen on the screen in such rapid succession that they're just a blur.

If you are a Subscriber Vision customer, however, you just slip a pasteboard card in your decoder. This card carries a switching circuit that speeds or slows the starting of the abnormal pulses so that they are in step. In one plan Skiatron would sell a card for a week's listening; an alternative would have the decoder punch a record of each use for separate program charges.

Zenith's Phonevision plans to charge separately for every program that you watch. The original idea was to put it on your phone bill—the decoding signal would be ordered from the phone operator and sent over the regular telephone lines, connected permanently with your TV set. Variations of this scheme, published here for the first time, need no permanent connection.

In one alternate plan, the operator gives instructions telling you how to adjust your decoder manually to receive the program you have chosen. (Your setting would fit only your receiver, not the neighbor's.)

In another plan an electronic switchboard would reset your decoder in a few seconds by pulses sent over your telephone from the Phonevision office. A third way would use vending machines located in public places and connected to the switchboard by permanent wire. Coins would unlock the machine, you'd dial your program, and a printed card would drop out with your decoder setting on it. This would make it unnecessary for you to have either a telephone or standing credit. All these various plans can use any of the different scrambling systems being considered.

Telemeter's distinctive device is a separate coin box on every home decoder. A window in the decoder device shows the cost of the program; dropping in the right amount unlocks the decoder and clears your picture. The price window is operated by pulse signals from the transmitter. Other

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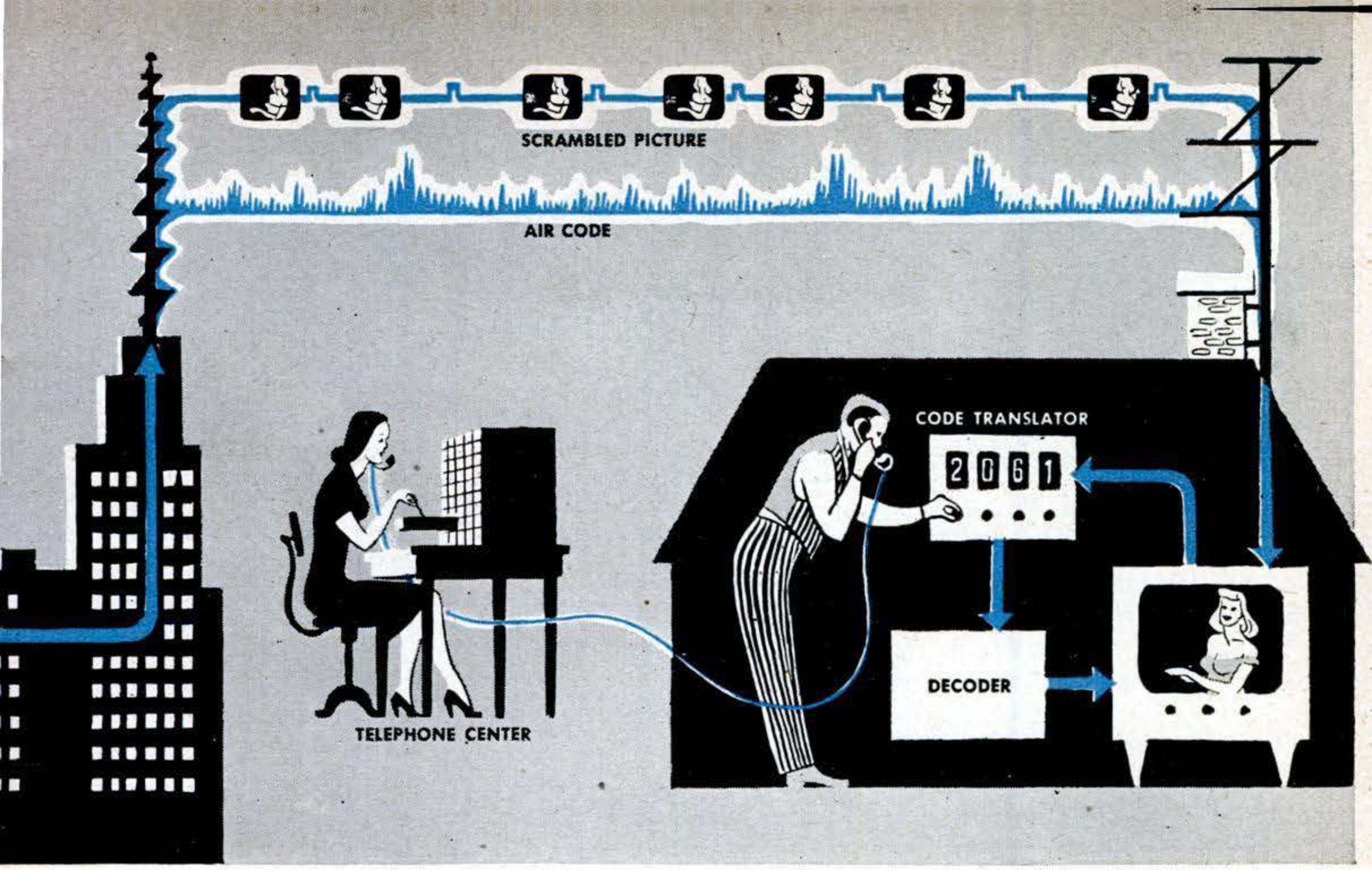
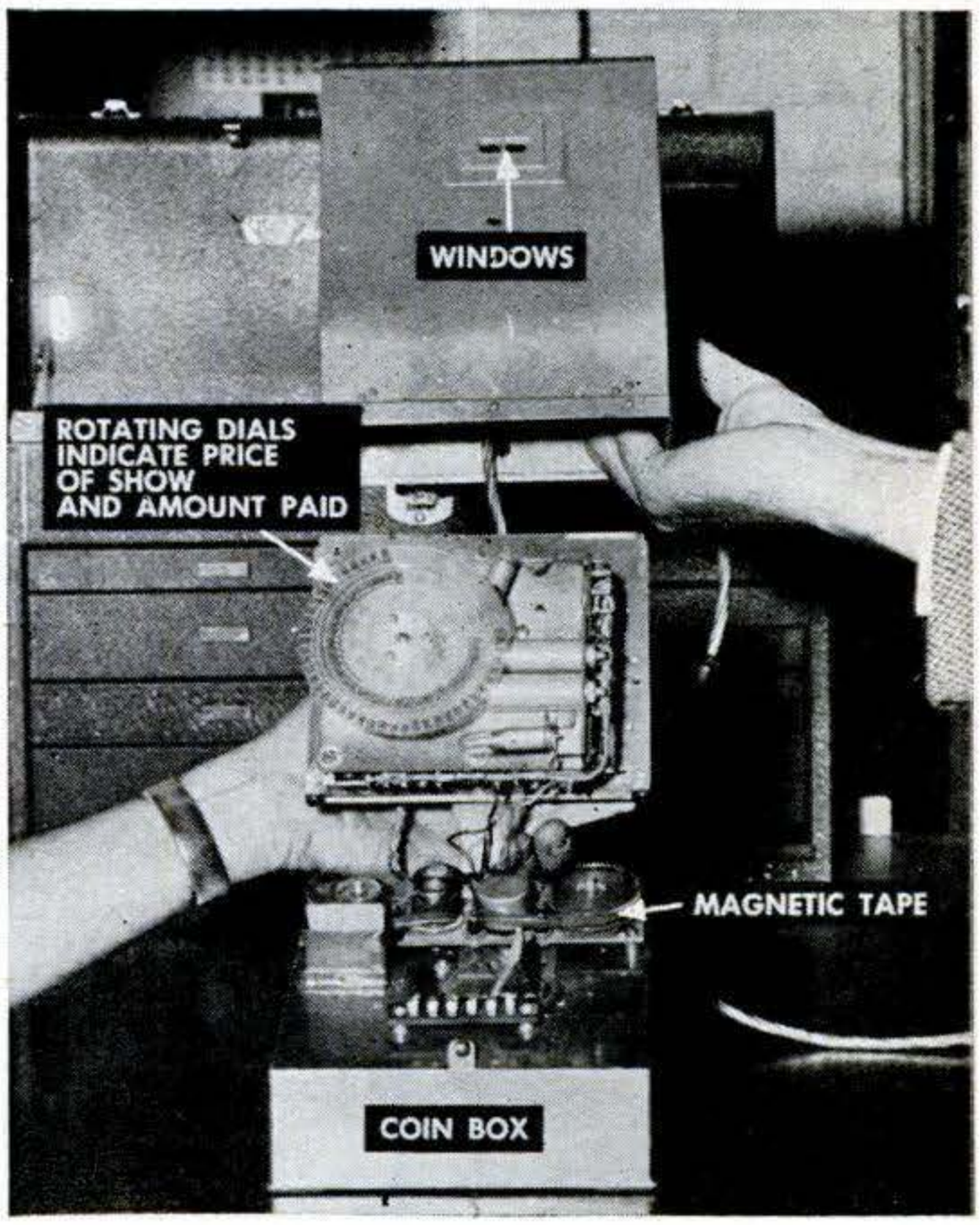


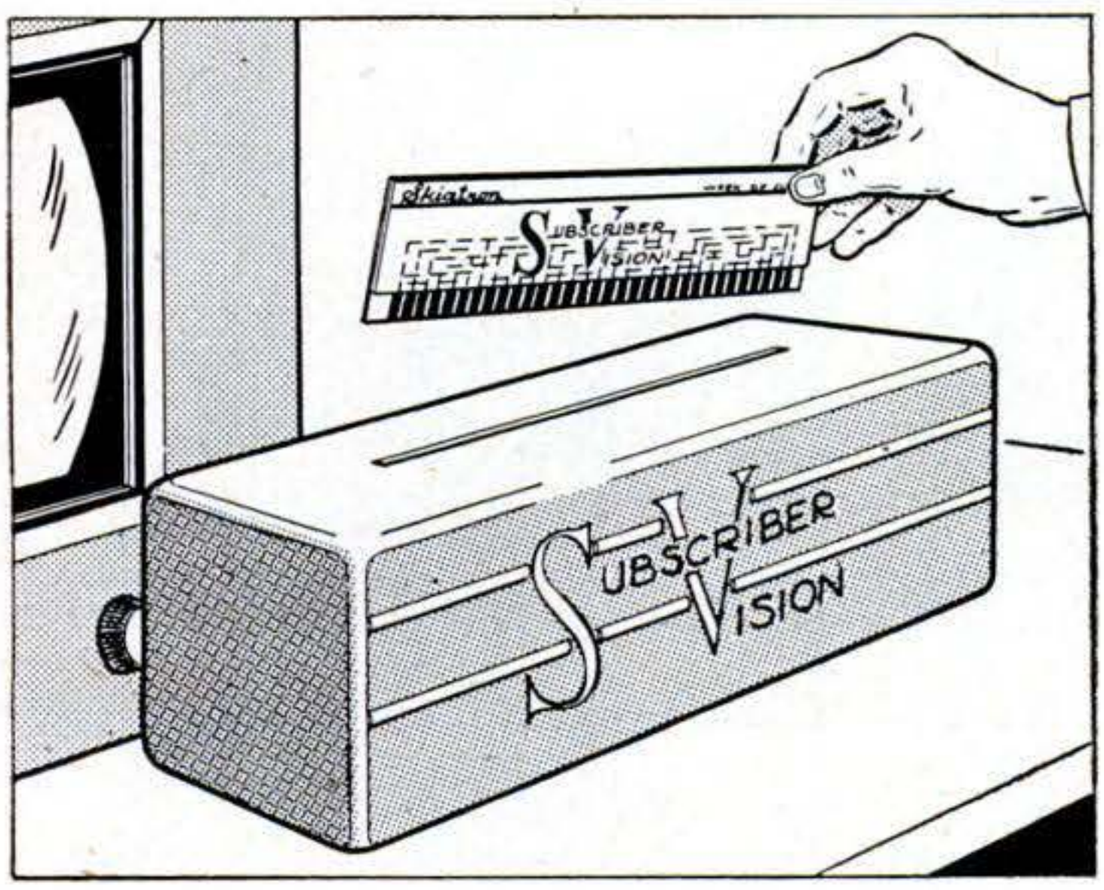
pulses send the code number of the program, which is tape-recorded inside the coin box.

None of the three systems has permission from the Federal Communications Commission to operate on a regular schedule. Two big questions loom. Will the FCC abandon the concept that everything that goes out over the air must be free? If it does, will its okay cover the general principle, so that there will be competition among the three types, or will it adopt a single system so that the set owner can get all subscription programs with one decoder?

Zenith and Skiatron say that they are on the verge of popping the question. Don't be too surprised if someday you find yourself paying to turn on your TV set! END



TELEMETER DECODING BOX. Coin box at bottom above is changed each month. Magnetic tape records code numbers of programs purchased. After collection, tapes are scanned automatically and proceeds apportioned among shows.



SUBSCRIBER VISION DECODER (left) is operated by card on which circuit is printed in metallic ink. New card is mailed to customer for each code change. For long subscriptions master cards can cover several codes. Cards can be combined with coin-operated lock.

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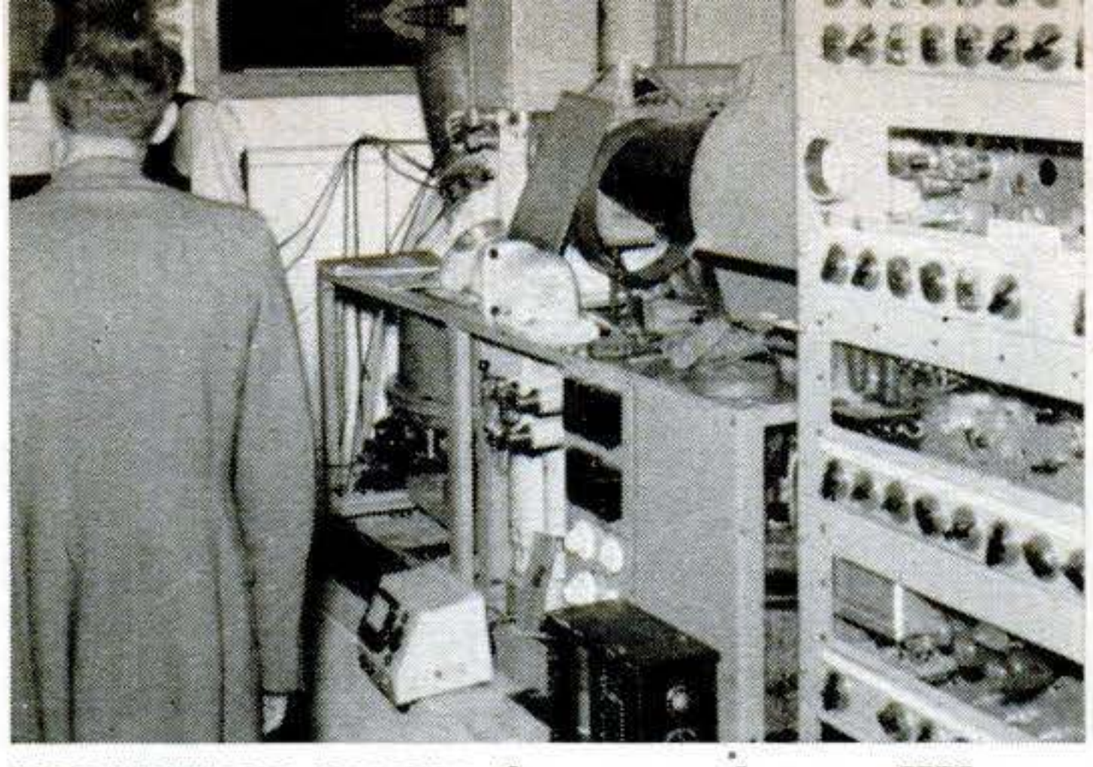
Projector Puts TV on Biggest Theater Screen

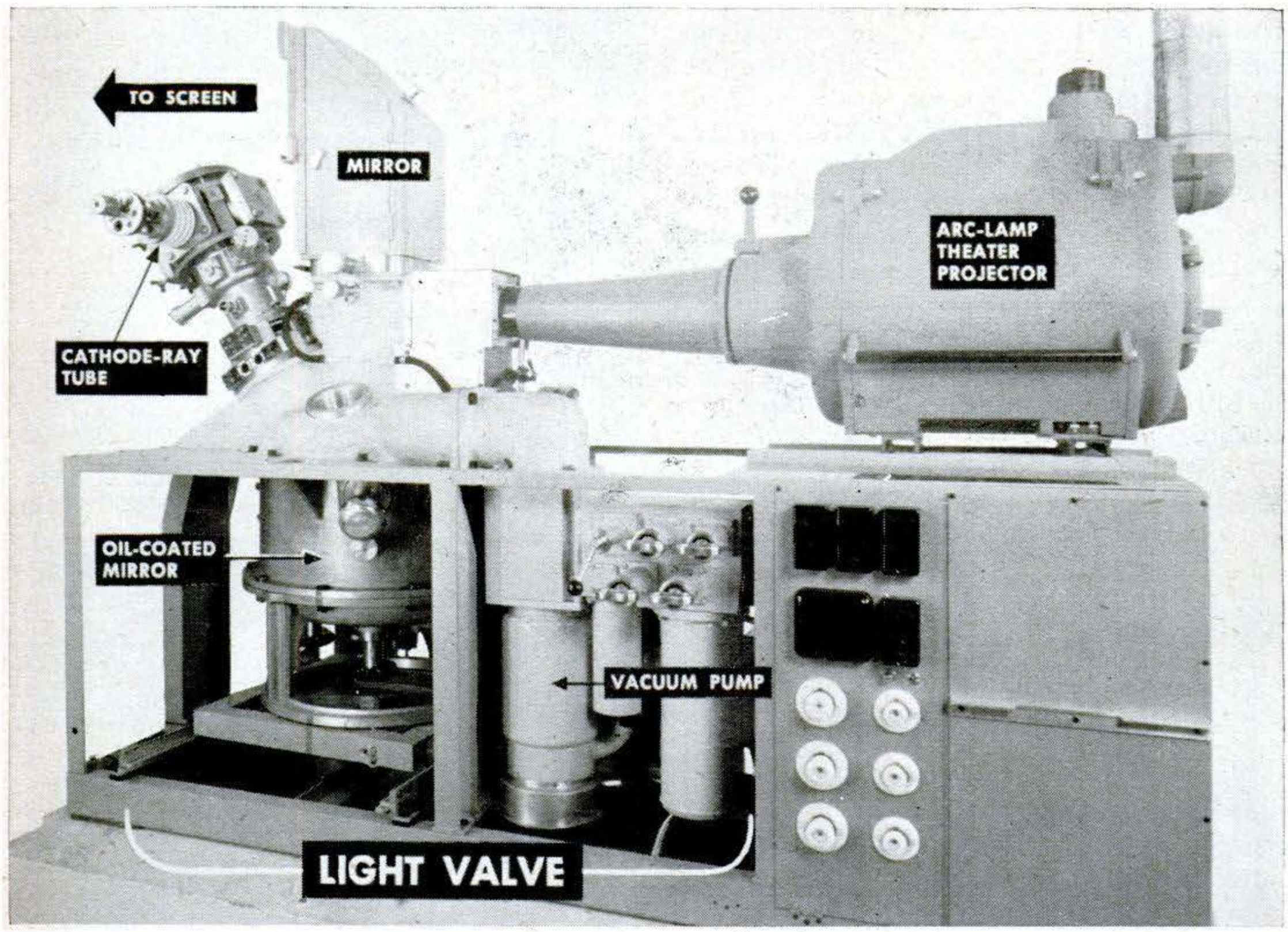


PROJECTION BOOTH for new theater-TV system resembles one for showing movies and can have similar location in theater, instead of requiring special setup close to screen.

TELEVISION pictures can now be made bright enough for the largest theater screens. The new projection system avoids the difficulty of getting a big-enough, bright-enough picture from the limited brilliance of a TV-tube image. It uses a powerful arc beam similar to a movie projector's.

The electrons coming from a special TV tube, instead of striking a fluorescent screen, bombard an oil-coated mirror in a light valve. This produces ripples in the oil. The mirror reflects the arc beam to the theater screen through a grid of silvered bars. Where there are no ripples, the arc beam is blocked by the grid, no light gets through to the screen, and a dark area results. Where the ripples appear, they bend the beam just enough to get past the grid to the screen, producing a light area. Thus the arc beam continually projects a light-and-dark pattern corresponding to the light-and-dark TV image.

The new Swiss-invented apparatus, called the Eidophor system, can project either black-and-white or full color. It will soon be introduced in U.S. theaters by the Twentieth Century-Fox Film Corp.



NEW THEATER-TV PROJECTOR uses powerful arc beam to project large, brilliant pictures. Beam, on way to screen, is reflected onto oil-coated mirror in vacuum chamber by set of silvered bars in a light valve. Where electron-bombarded oil is not rippled, beam is reflected straight back to bars and blocked by them. Where ripples occur, they bend beam so it passes through slits between bars and reaches screen, reproducing TV image.

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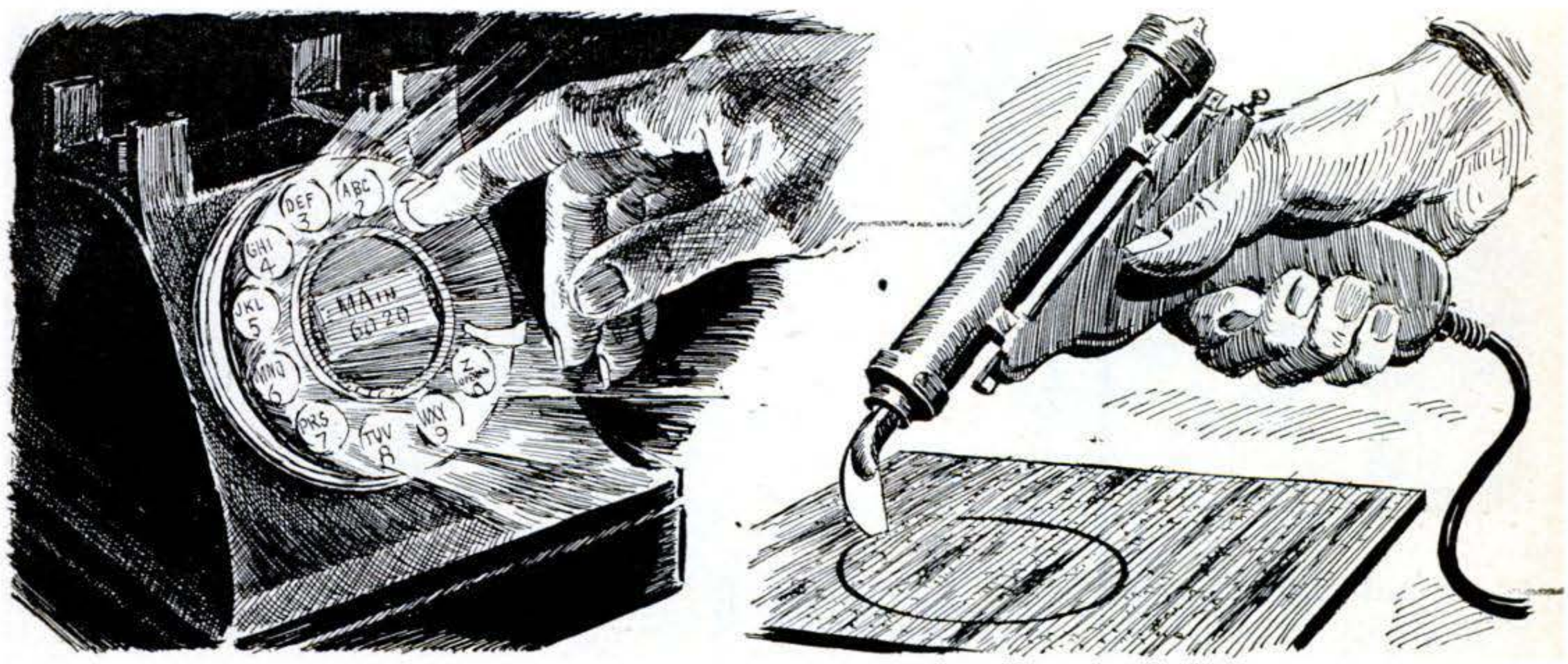
New Ideas from the Inventors

1 Wired "Radio" to Signal Fire. In a home safeguarded by this invention, the regular house wiring circuit would serve as a fire-alarm system. Tiny transmitters actuated by heat could be plugged into any 110-volt outlet to send their warning signals over the power-supply wires. The alarm would be sounded by a receiving unit—possibly part of a bedside radio—plugged in anywhere else on the same line.



2 Light to Make Phoning Easier. Lifting the handset off the cradle of a telephone improved by this invention would automatically illuminate the dial. A small electric light concealed in the dial wheel would make the numbers and letters plainly visible—and save you the trouble of turning on a lamp before using the telephone.

3 Heater to Warm Linoleum Knife. It's easier to cut linoleum accurately if you warm the blade in a blowtorch now and then. This invention would save you the trouble. A built-in electric heating element would keep the blade at the right temperature. Asphalt tile also could be cut with it without first being heated.

Please turn the page for three more new ideas.

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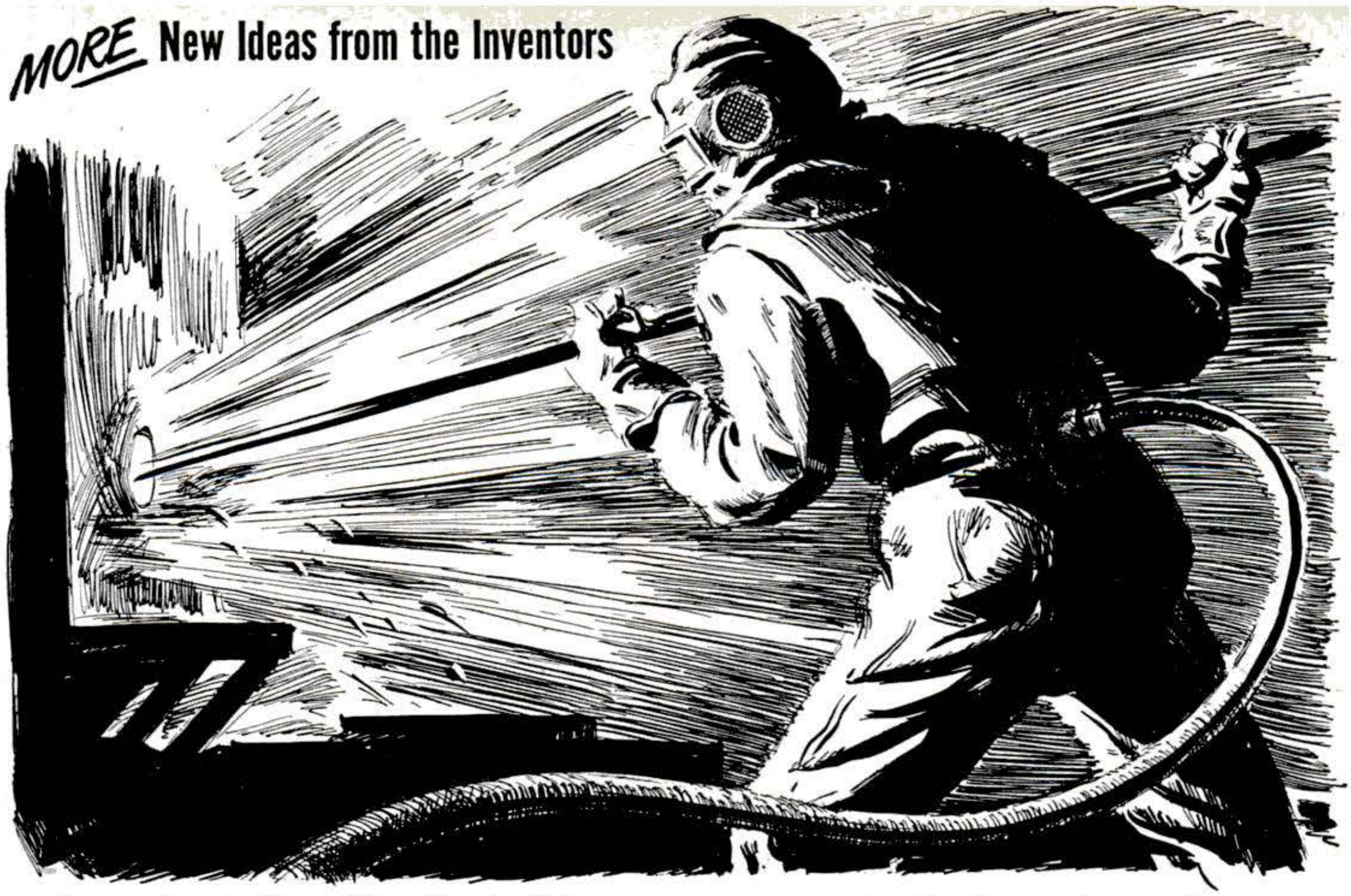
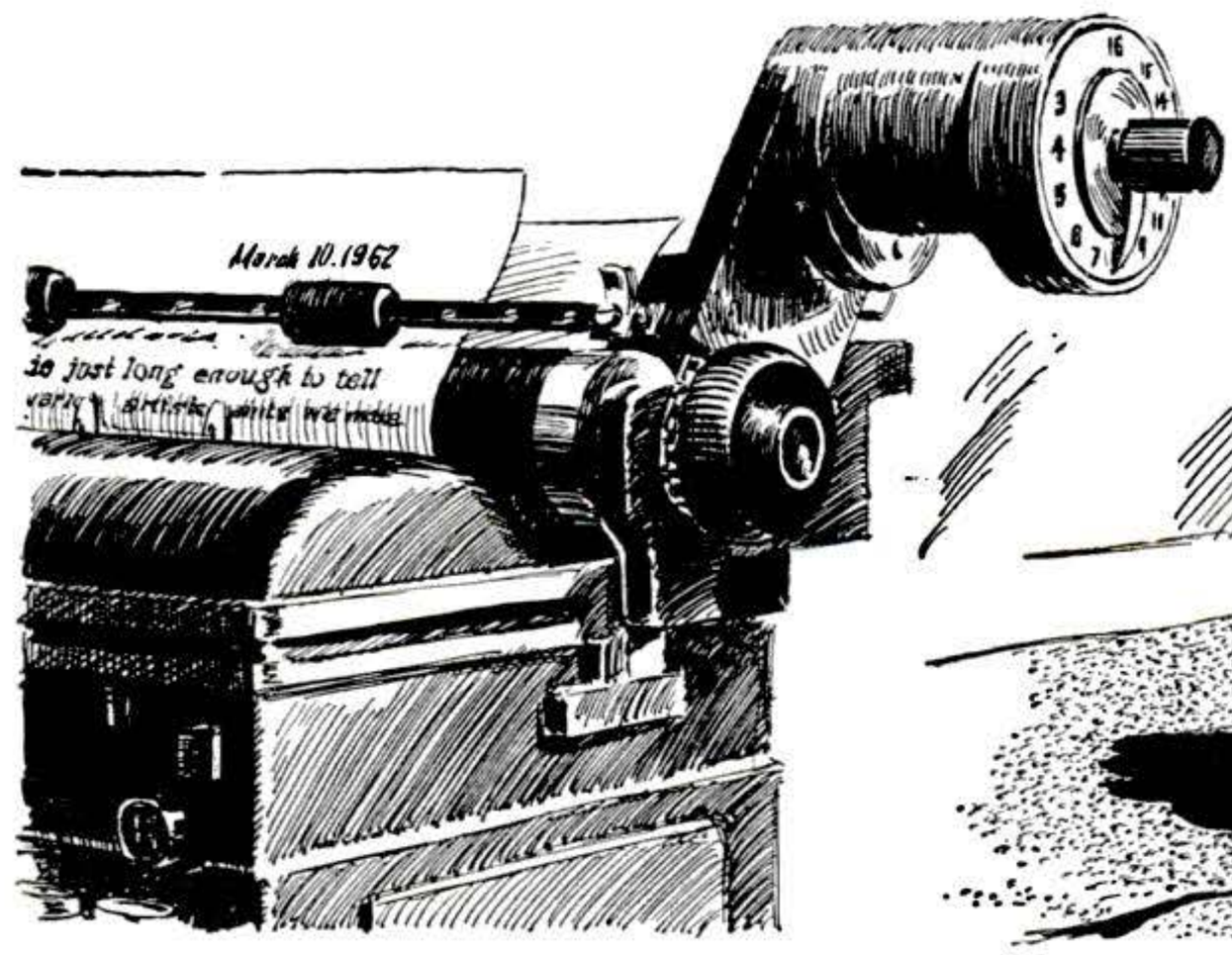
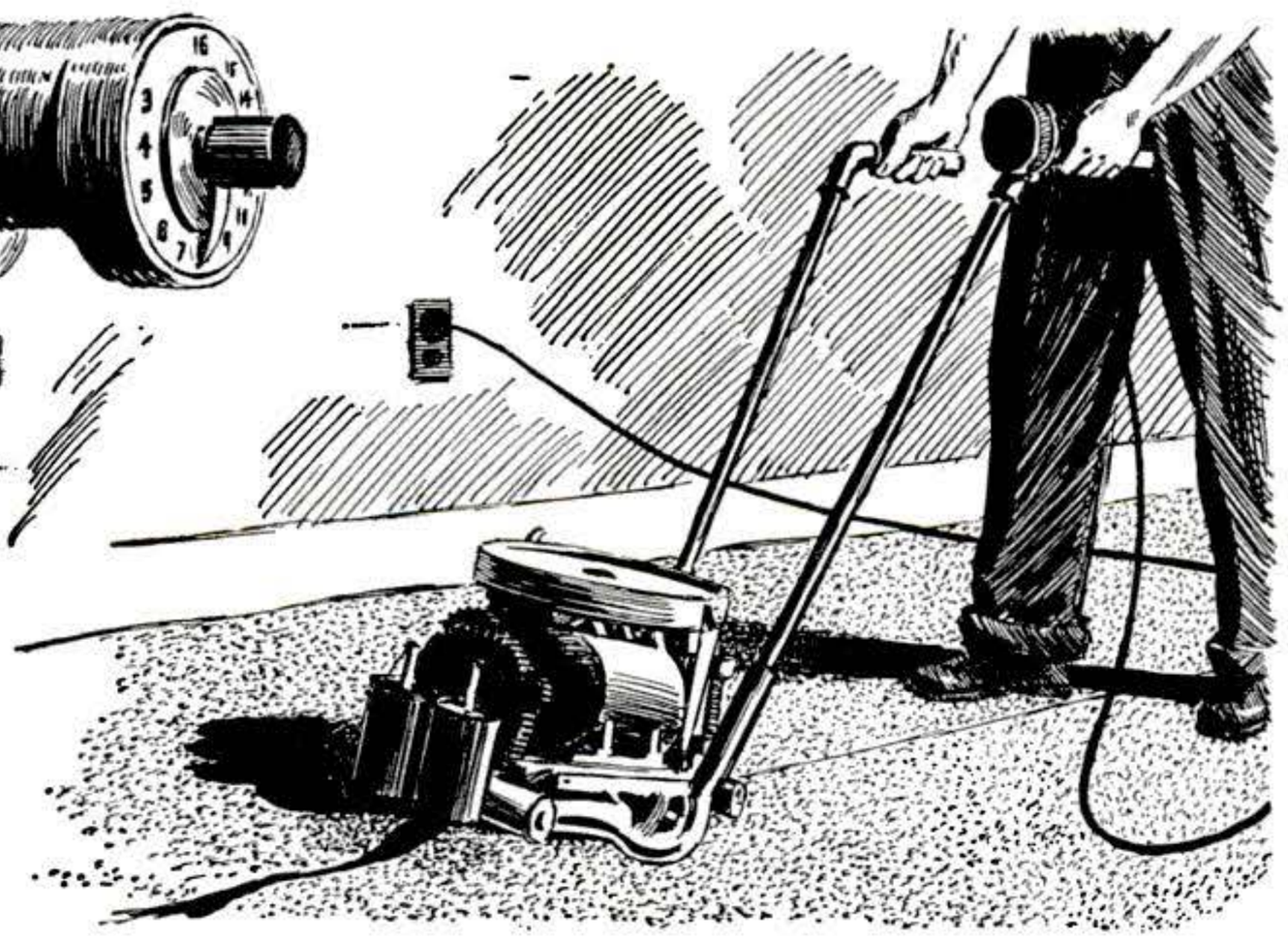
MORE New Ideas from the Inventors



4 Coveralls to Keep You Cool. This garment is for men with hot jobs. The inventor proposes that it be made of dirigible fabric with an outer surface of aluminum to reflect heat and a black inner surface to accept and distribute heat that came through. It would be inflated at a moderate pressure to keep an air blanket around the wearer, and connected to a cool-air circulating system.



5 Signal to Aid Typists. On a typewriter fitted with this device a bell would ring when you reached a predetermined bottom margin. There would be no chance of running off the end of the paper or spoiling the spacing of a letter. You would set a dial to the inches of typing desired.



6 Machine to Sew Carpet. This mobile electric sewing machine is designed to stitch together strips of carpeting as they lie on the floor after being cut to fit the room. Pushed along the abutting edges of the carpet, a special stitching device would join the two edges.

Patents on these inventions have been granted to: 1. D. Decker, Belmont, Mass.; 2. O. Shann, Short Hills, N. J.; 3. J. Smith and J. Sidwell, Murfreesboro, Tenn.; 4. K. Dunn, Corning, N. Y.; 5. J. Allemann, Santa Ana, Calif.; 6. M. Ashley, Arlington, Mass., and E. Fearing, Quincy, Mass.

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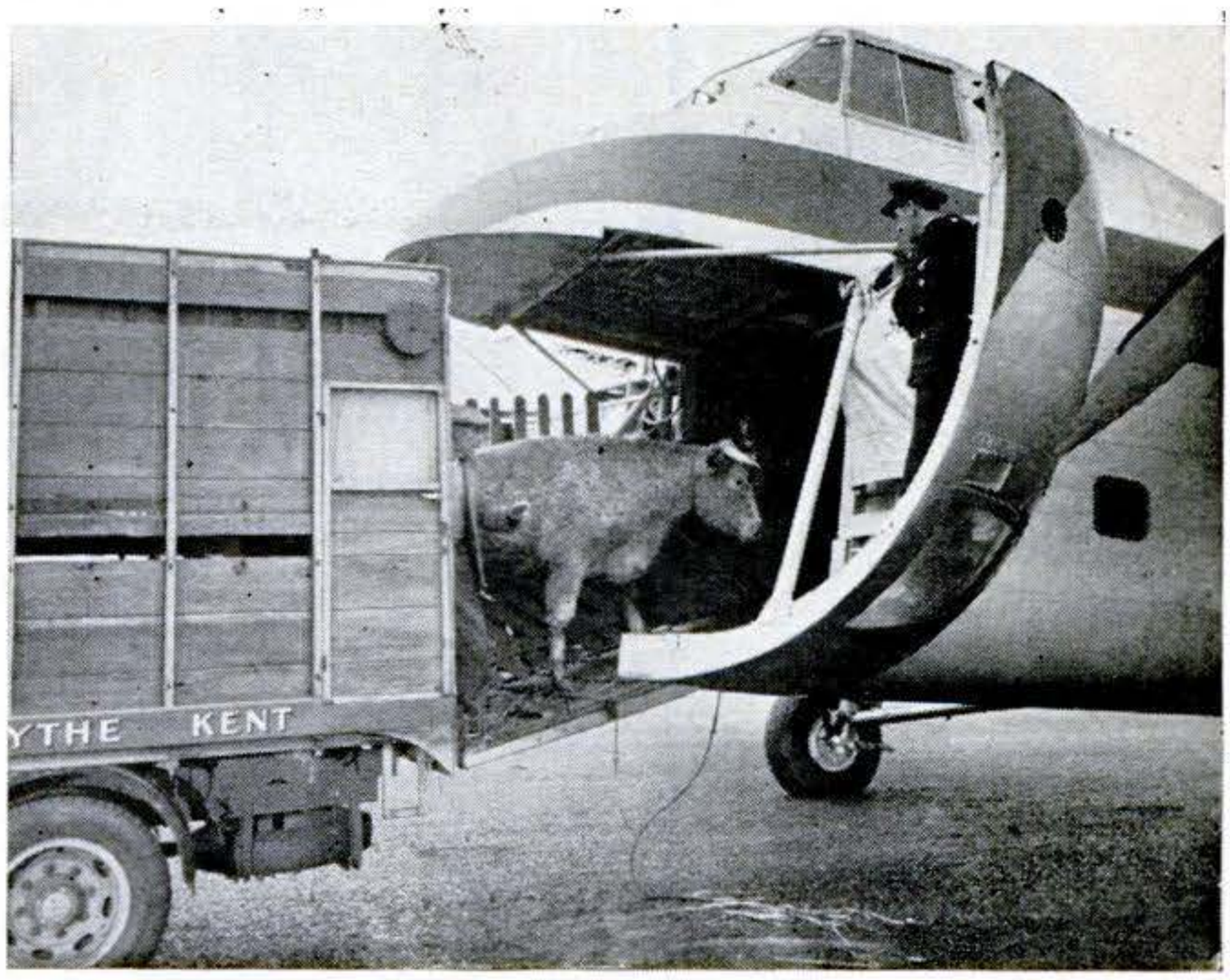
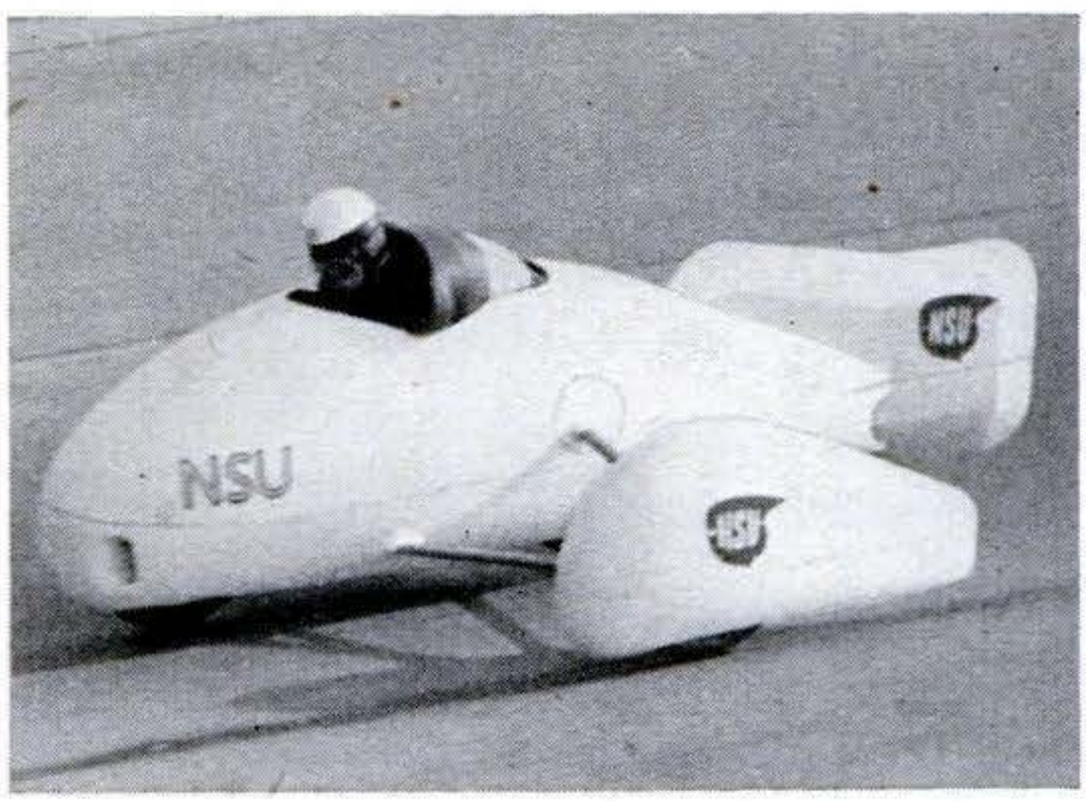
Cows Prefer Air Travel for Ride Across English Channel

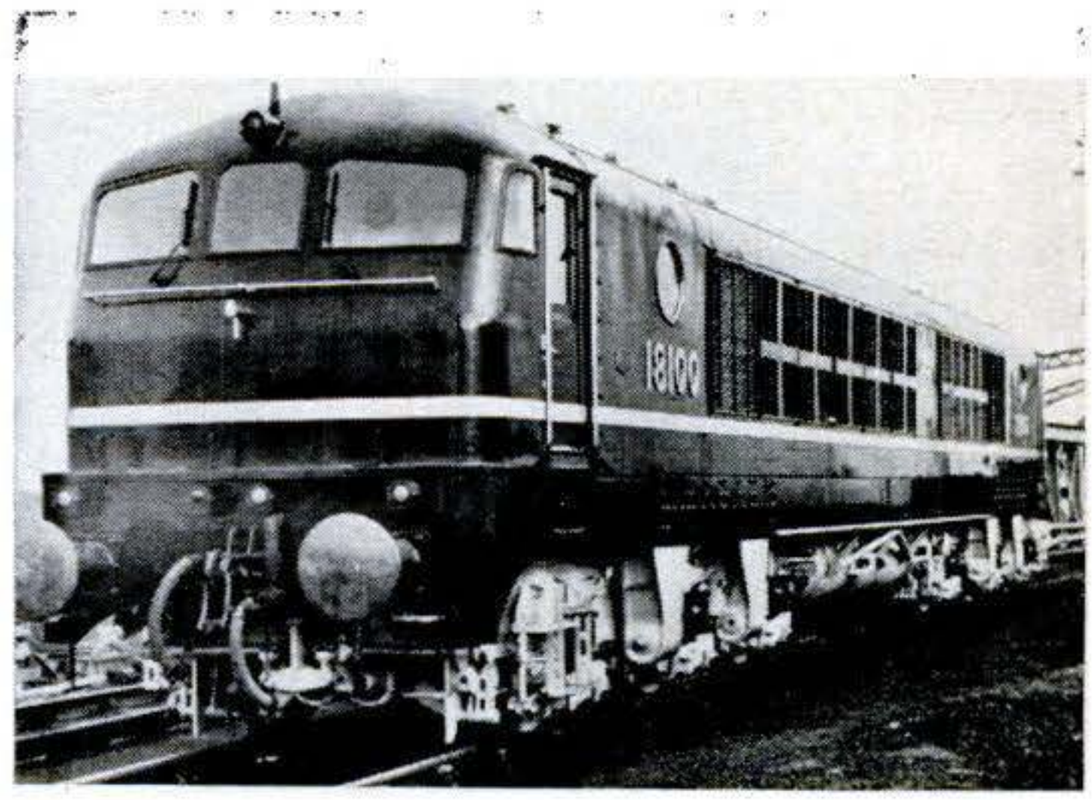
A TWO-HOUR boat trip across the choppy English Channel can be as rough on cows as it is on people. So now some 300 head a week go by air on their way from Ireland to Italy—flying in the comfort of special stalls with padded windows. The flight from Lympne, Kent, to Le Touquet, France, takes only 20 minutes and the cows are said to like it better. Eleven small cows or eight big ones can be carried in each Bristol Freighter of Silver City Airways, whose main business is air-ferrying automobiles back and forth across the Channel.





Sidecar Racer Makes Record 154

THIS streamlined German NSU motorcycle holds the world's speed record for cycle-and-sidecar: 154 miles an hour. The outrigger, connected to the motorcycle shell by three beams, carries a 132-pound steel plate to represent the weight of a sidecar rider. The two-cylinder, four-cycle, supercharged engine produces 110 horsepower.



Turbine Speeds British Trains

A NEW turbo-electric locomotive can drive British trains as fast as 90 miles an hour. Built by Metropolitan-Vickers, it has a gas turbine turning an electric generator. The turbine develops 3,500 horsepower of which 2,800 can be delivered to the motors on the driving wheels of the 70-foot-long, 120-ton locomotive.

Britain's First Twin Helicopter Tries Her Rotors in Flight

HOME of the first interurban helicopter service, England has a new whirling-wing aircraft to expand such air routes. It's the Bristol twin-rotor 'copter (left) that can carry 13 passengers or, as a freighter, lift 2,500 pounds of cargo. Powered by two 550-horsepower engines, it cruises at 105 miles an hour, has a top speed of 142.

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"No Live Operator

Remote radio control of combat planes is no longer a stunt. Here's how the robots might be used as push-button weapons.

By Herbert O. Johansen

A HUMP-BACKED four-engine Constellation, bristling with antennas and packed with electronic gear, flies off the Atlantic Coast. She is accompanied by a flock of Navy fighter planes that carry no human pilots in their cockpits.

Instead, a remote pilot in the PO-1W Constellation mother plane "plays a tune" on a little black beep box at his fingertips. With it, he can send the fighter drones through any maneuvers that a pilot in the cockpit could—plus some that a live pilot probably couldn't take.

Today these drones are converted World War II fighters—propellered F6F-5K Hellcats. They could just as well be our fastest jets. And the PO-1W mother plane could be our fastest jet bomber.

Even now, that bulging Constellation not only carries radio-control gear for her string of drones but also early-warning devices that make her a sky-patrolling Combat Information Center. At high altitudes, her radar can see far beyond the horizon that limits the range of ground or shipboard radar eyes. If an "enemy" were sighted, she could radio the location and movement to a carrier or a land air station.

The interceptor-fighters that would be sent up to meet such an attack if it came today would be fast, piloted jets. But radio-controlled, pilotless drones could do the job without risk of human life.

Already, two external turbojet engines have been added to boost the speed of an F6F drone. A supersonic, all-electronic, robot jet airplane is on the drawing boards. And some drones are being fitted with special equipment that will permit more precise control for evasive action at very low altitudes—50 to 200 feet.

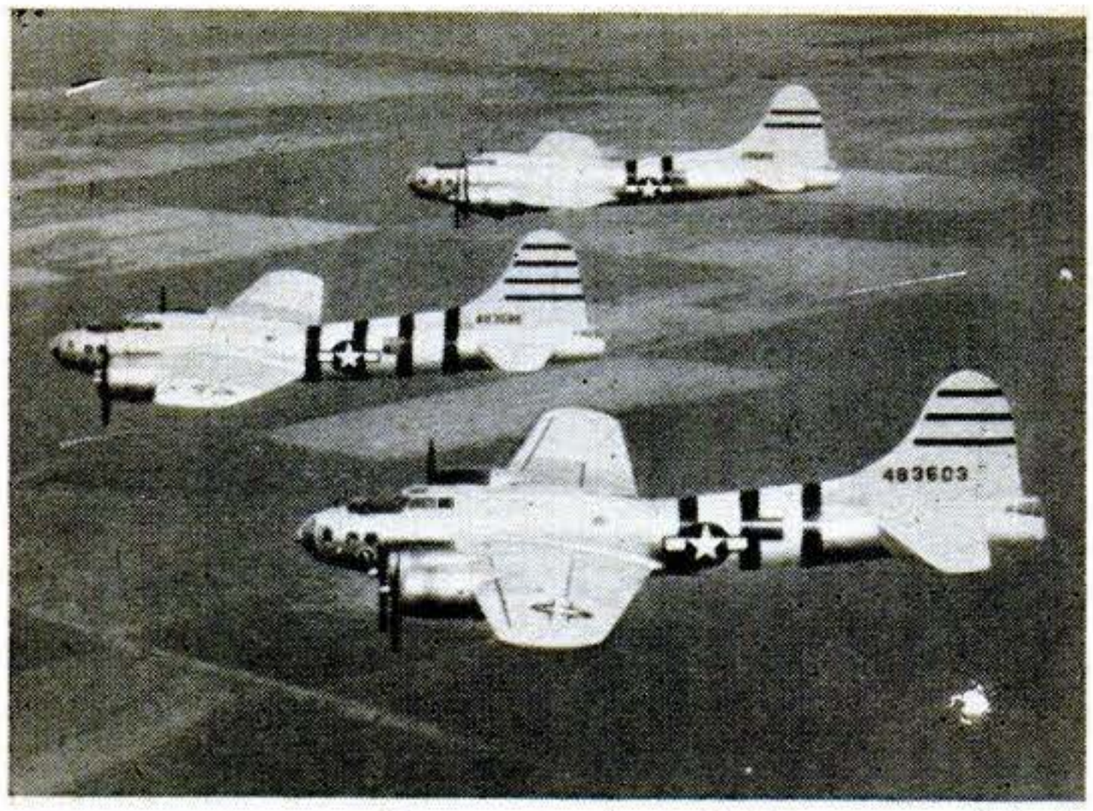
The Navy has a name for drone control—NOLO, meaning "no live operator aboard." The scheme was born of a need for a more realistic target for gunnery practice. The robot Hellcat makes a good one. With heavy armor plate protecting its vitals, it can take a lot of shooting at—and come back for more tomorrow.

I got fairly well acquainted with these tar-

Aboard"

HELLCATS flying in formation above have no pilots in their cockpits. They are drones under radio control from the four-engine PO-1W mother plane—an electronics-packed Constellation that serves as a flying Combat Information Center.

PLAYING A TUNE on the beep box, the author remote-controls a drone at the Naval Air Development Center. With him (right) is Lt. T. J. Dollard, who has more than 250 hours of beeper-pilot time.



BIG FELLOWS also can be radio-controlled. Here three Air Force Flying Fortresses are being flown in perfect formation by a beeper pilot in a mother plane that is out of the photo.

get Hellcats during a recent visit to the Naval Air Development Center at Johnsville, Pa., where they get the electronic guts that make them drones. I went out on the airstrip and saw one in robot flight. I even played a brief tune on the beep-box control unit that was flying the drone.

But what I really saw at Johnsville was more than just a guided target plane. Using a little imagination, I saw what is actually a guided missile—a practical push-button weapon ready for use now.

The experimental Buck Rogers types of guided missiles and pilotless bombers, such as the Matador recently announced by the Air Force, may be ready for action tomorrow. They "rocket" high and fast—but there are too many launching fizzles, longer range is needed, and the electronic gear to make them behave in flight is still to be perfected.

These pilotless drones could be made ready for action today.

There is no mystery or secret behind the operation of these robots. Flight stability in the drone is maintained by an automatic pilot that responds to beeps or radio impulses sent out by the remote controller.

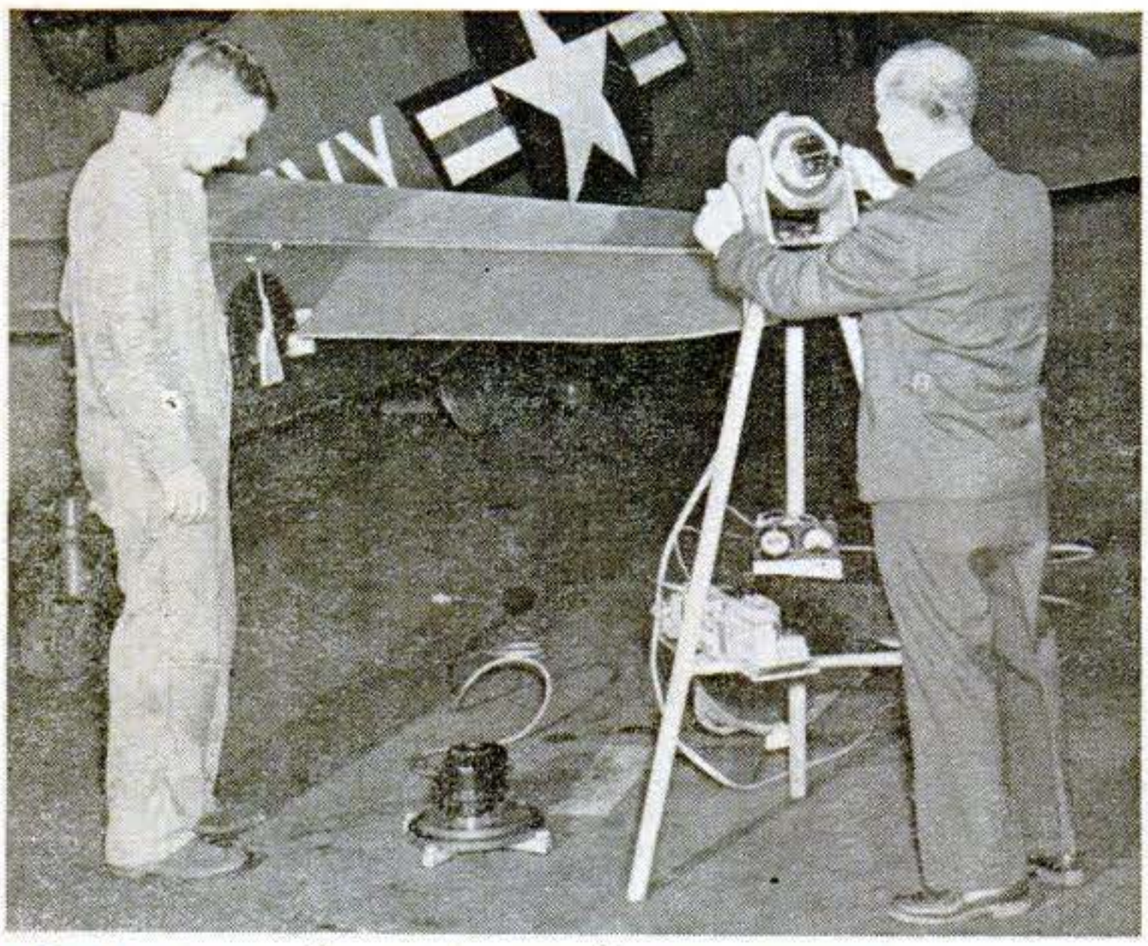
The radio signals from the controller unit go into the drone's receiver-selector and are channeled to operate electronic devices that do such jobs as regulating engine power, raising and lowering landing gear, moving flaps, adjusting rudder and ailerons, and putting on the brakes.

Beeper Pilot Must Be Expert

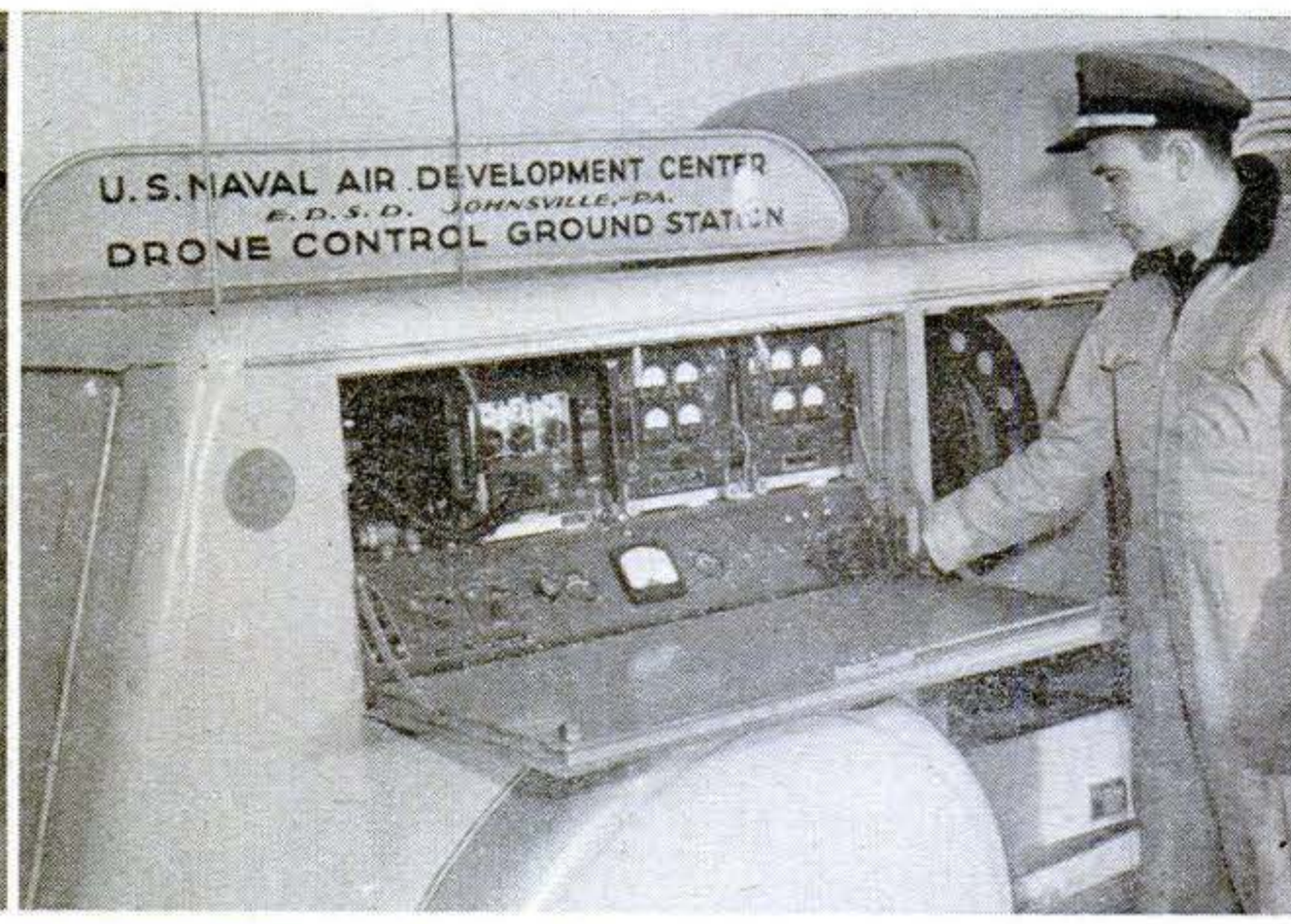
The symphony of robot flight is played by the remote-control pilot on his black beep box. It has a miniature control stick, push buttons and various toggle switches. When he pushes the stick in one direction, his transmitter sends out a signal of a certain frequency. Picked up by the drone receiver, it is channeled to a servomechanism that makes the drone do what he wants —dive, climb or turn.

It takes long practice to make a good controller. You can't feed the signals in too strongly or abruptly, or the drone reacts too violently. A few fast and gentle flips of the stick or switches do a smoother job. After a time a man develops a touch and plays the beep box with the finished technique of a concert pianist at his grand.

At the Naval Air Development Center I saw the simplest running over of the scales. Only one drone was under control. Since it was flying over an inhabited area, there was a safety pilot in the cockpit. And the plane



CHECK-OUT: Gyro is used on ground to test drone's response to beep-box bank signals.



TRANSMITTER and modulator are shown in this view of ground-control Fox Cart.

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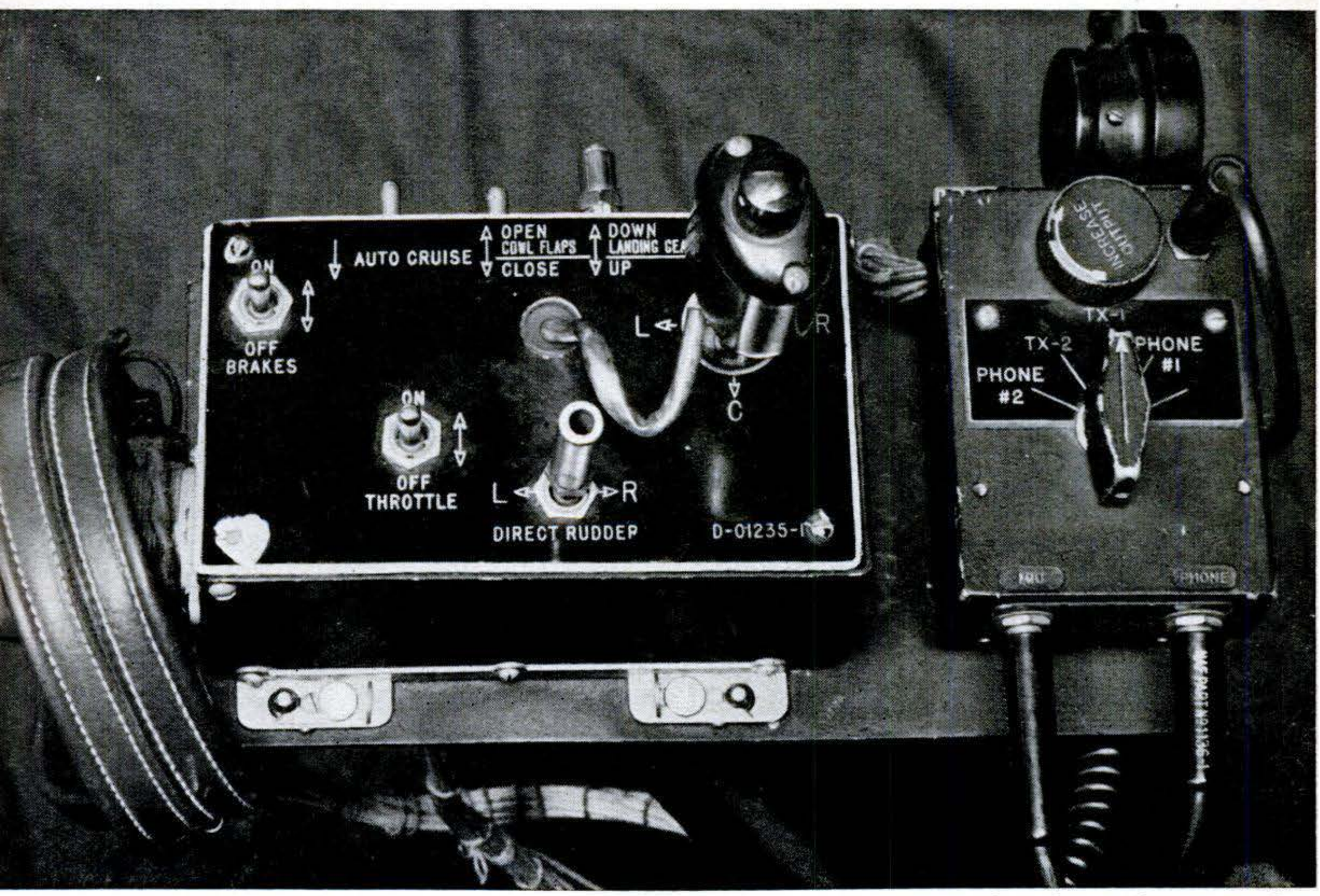
A PERFECT DRONE TAKE-OFF. As this Hellcat flew out of the picture, Lieutenant Dollard raised the landing gear of the plane by flipping a toggle switch on his beep box.



GROUND PILOT'S "KEYBOARD" is shown in close-up of his beep box. Radiophone is for communication with safety pilot or mother plane that takes over when drone is airborne.

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BOMBARDIER'S BUBBLE is beeper pilot's roost in B-17 mother plane. Television monitor enables him to view directly the flight path of a remote-controlled drone.

had to be kept in sight of the ground operator. For more distant control, he could have turned his job over to a controller with a similar beep-box unit in a mother plane that would have kept the drone in sight.

From that point, it would be simple to put a radar set in the mother plane to keep the drone in radar view for "out-of-sight" control to a distance of several hundred miles.

Multiple Control No Problem

The next logical step would be to increase the mother plane's family. The Navy has flown at least four drones under a single control, but theoretically there is no limit to the number that can be handled. And, fortunately, it does not require a duplication of transmitting equipment for each drone added to the string.

As an example of how it might work, imagine 12 drones as 12 separate radio sets in your living room. You could tune each one to a different station and program. That would represent having a separate beep-box transmitter setup for each drone.

On the other hand, you could tune all the radio sets to one station. With relays and delay switches you could fix your 12 radio sets so that each set received about one word of an announcer's message in sequence. This, in principle, is how the radio-control transmitter in the mother plane and the remote receivers in the robots could be modified to handle a herd of drones.

With a setup like that, you'd need some more radar sets and extra controllers to keep track of and direct the various drones assigned to different missions—missions far afield from the routine jobs of being a flying duck for gunnery practice, or even running coastal patrol against submarines.

What Drones Could Do

A whole family of drones could, of course, be remote-flown in formation and radio-directed to a single target. Or—and these are my own conjectures, for the Navy is still close-mouthed about future possibilities:

- Some drones could carry bombs to drop on an enemy bridge or rail center—or carry atomic warheads and crash-dive as projectiles of destruction.
- Others could have a wing load of rockets to blow up an ammunition dump.
- One might have wing-tip or belly-mounted cameras and be sent off on a photo-reconnaissance job.
- One or all of the drones could have nose-mounted television cameras to send back intelligence from behind enemy lines. TV, in effect, would put the eyes of the remote controller in the cockpit of the drone.
- In case of enemy aerial attack on the mother plane, she could pull back some drones to act as her fighter escort.

But who would drop the bombs, fire the rockets, shoot the guns, snap the camera shutters of all these busy drones? Why, the remote-controller—he would just play a somewhat fancier tune on his beep box.

Enemy Jamming a Threat

What about enemy jamming of radio transmission? Without those vital beeps, wouldn't the drones be helpless orphans? Not necessarily. When a drone approaches its target, it could readily be cut off from the mother plane's radio apron strings. Its automatic pilot would have preset instructions that would guide it into and away from the target on its own. When the drone was clear of jamming danger, the mother plane would pick it up again.

A drone might, however, get hopelessly out of control and head for a crash where the enemy could salvage secret equipment. But there could be a beep for that, too. It could set off strategically located explosive charges and blast the drone to bits. END

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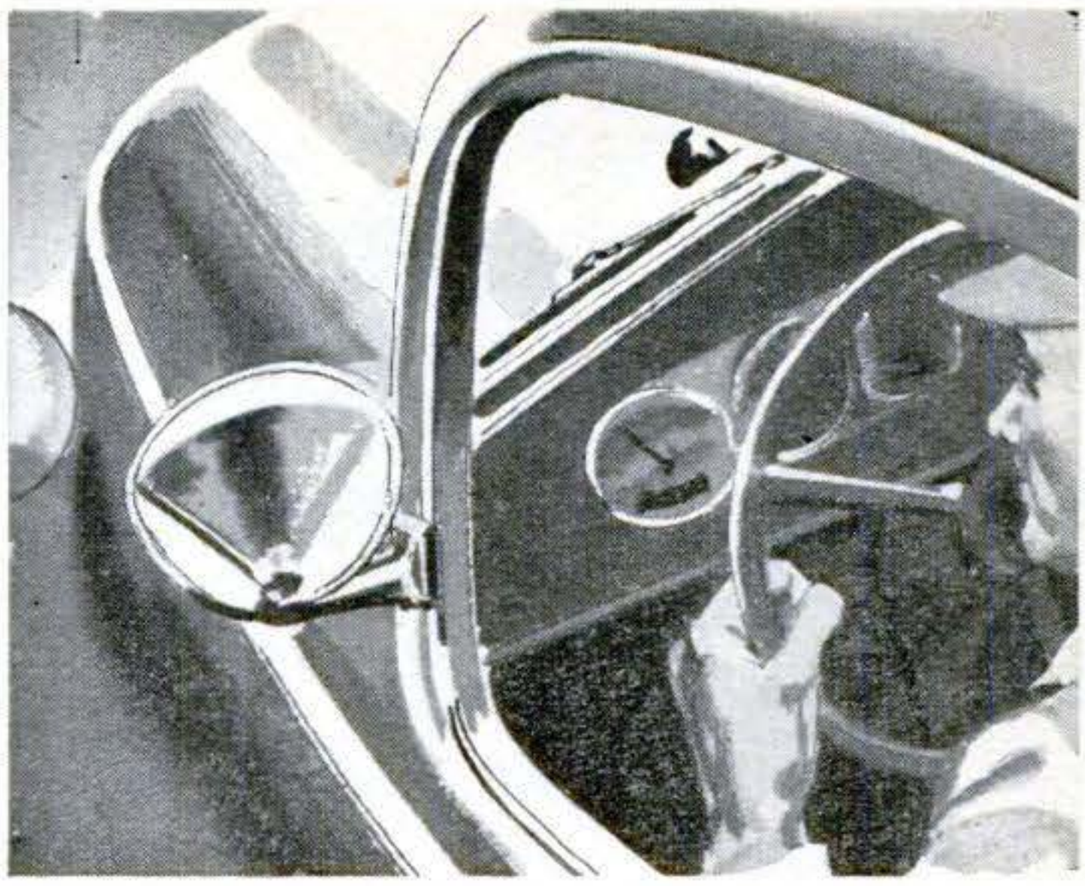
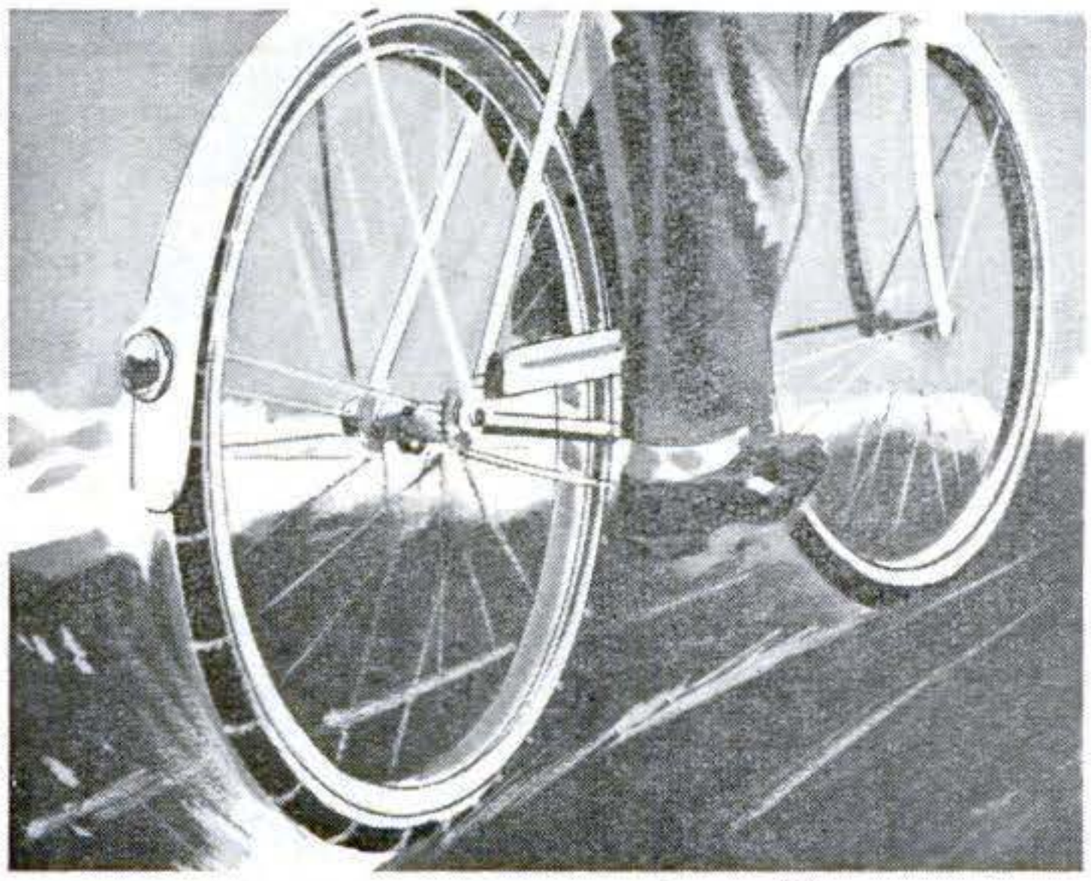
I'd like to see them make...

Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.



WINDSHIELD WIPER FOR REAR-VIEW MIRROR. An automatic wiper for the large rear-view mirror set outside a truck would be a safety factor.—*Howard Platek, Laramie, Wyo.*



CHAINS FOR BICYCLE TIRES, just like automobile chains, to provide traction when climbing icy hills or running through light snow. —*Bob Owen, Webb City, Mo.*

STAMP-VENDING MACHINES ON MAILBOXES. They would be especially useful for mailing letters after post offices and stores were closed. —*Violet Wolf, Jackson Heights, N. Y.*

A LIGHT TABLE WITH TWO-INCH LEGS, to be placed on top of a card table when serving refreshments, without disturbing cards, score-sheets, etc.—*Stanley Franzos, Pittsburgh.*

INTERCHANGEABLE FRONT AND REAR SEATS for four-door sedans. This would save the upholstery, since the driver's seat always wears out first.—*R. E. Sipes, Bettendorf, Iowa.*

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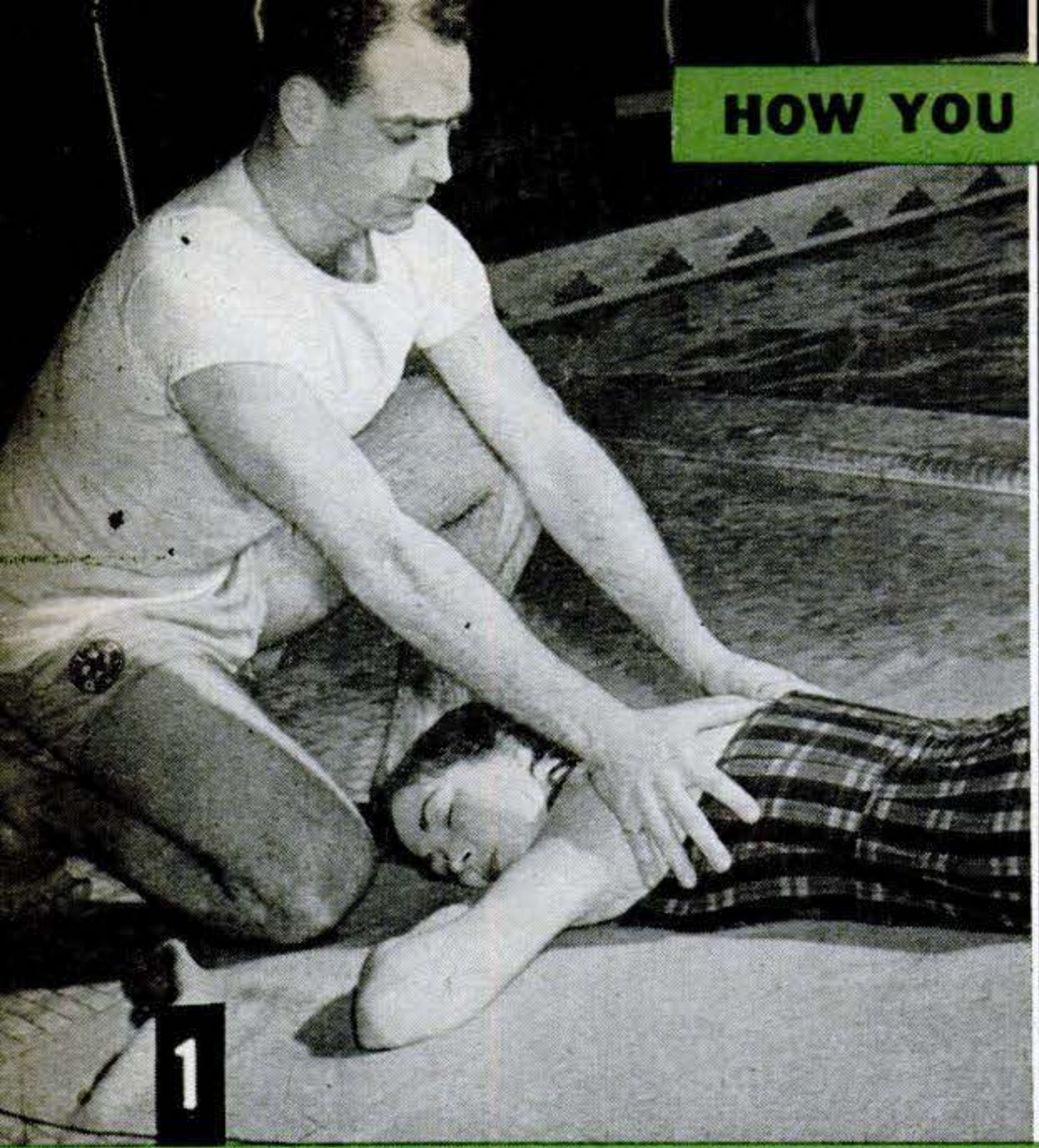

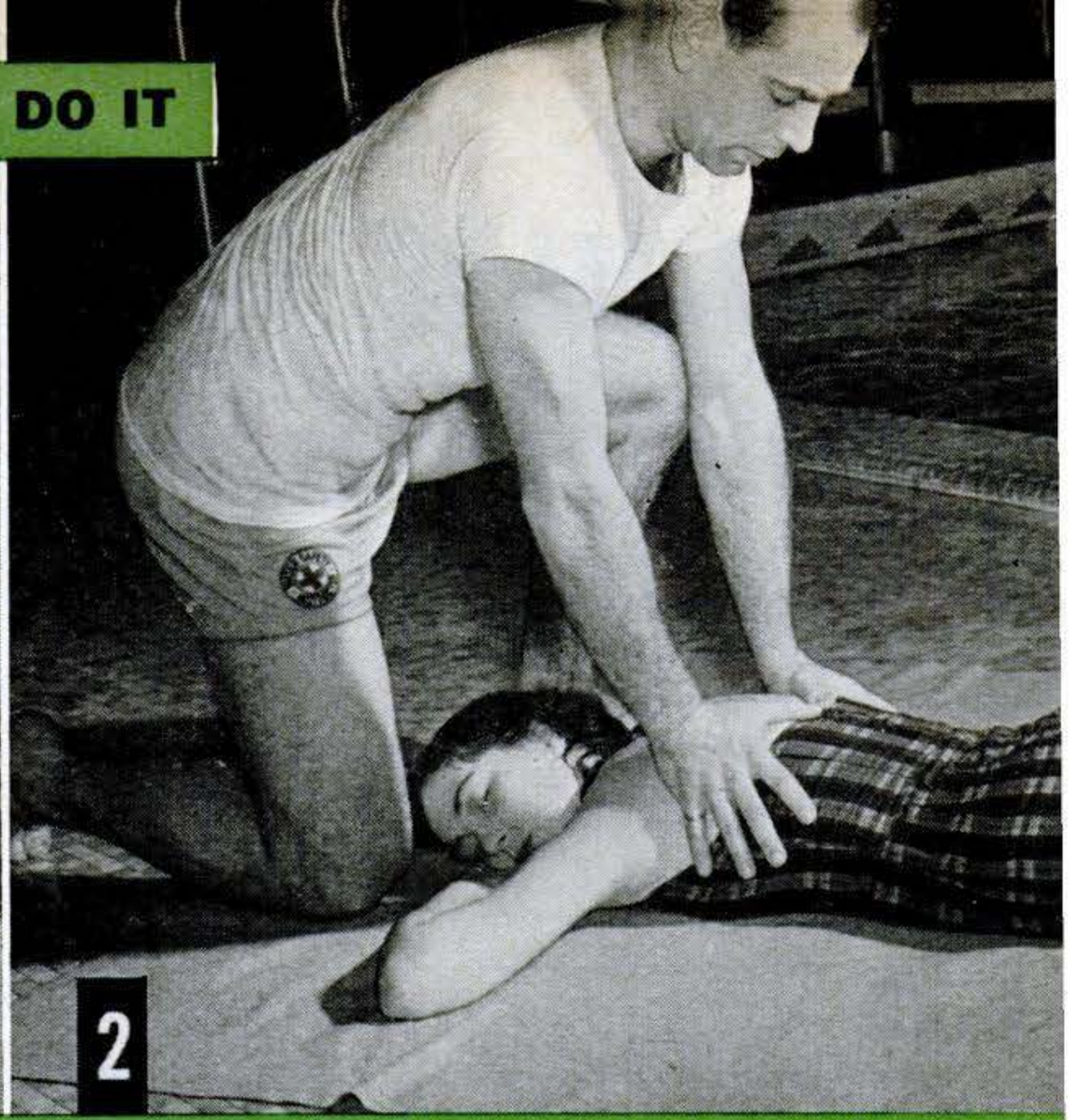

PUSH: "Drowning victim" is placed prone, elbows bent, arms under head, one hand upon the other, cheek on her hands. Operator kneels on one knee at her head, puts opposite foot near one elbow (1). He places his hands on her back with thumbs just touching and his hands just below a line running between her armpits. He rocks forward (2), elbows straight, until his arms are almost vertical, exerting pressure upon her back.

The New Official Method

An 85-year-old Danish swimming teacher's system of artificial respiration will be taught to 20,000,000 Americans this summer.

By Herbert Yahraes

IN THE cellar of Kronborg Castle at Elsinor, Denmark—scene of Shakespeare's *Hamlet*—an ancient warrior sleeps in stone, his long beard growing into a table. The warrior is Holger the Dane, a legendary hero, and the story goes that if Denmark is ever in dire distress, he will come to life and again assume his role as savior of his people.

Meanwhile, though, Denmark has brought forth a flesh-and-blood namesake—doughty Holger Nielsen—who will go down in history as the savior of infinitely more lives than the bearded warrior. For it is the modern Holger's method of artificial respiration that has just been adopted by the U. S. Armed Forces, the Red Cross, the Bureau of Mines, the Boy Scouts and virtually all other groups that teach first aid.

Tests on young men knocked out by curare—the deadly arrow poison of South American Indians—indicate that the new technique may save anywhere from 30 to 60 percent more lives than the Schafer prone-pressure method, which has been taught to Americans for almost half a century as the best emergency way to try to resuscitate victims of drowning, gas poisoning and electric shock. Put another way, these tests suggest that your chance of success—if you are ever called on to revive a drowned person—will be about one and a half times greater with the new method.

It's Not Really New

Actually, the "new" method is 20 years old, and the story of how it came, finally, to be adopted in the U.S. is largely the story

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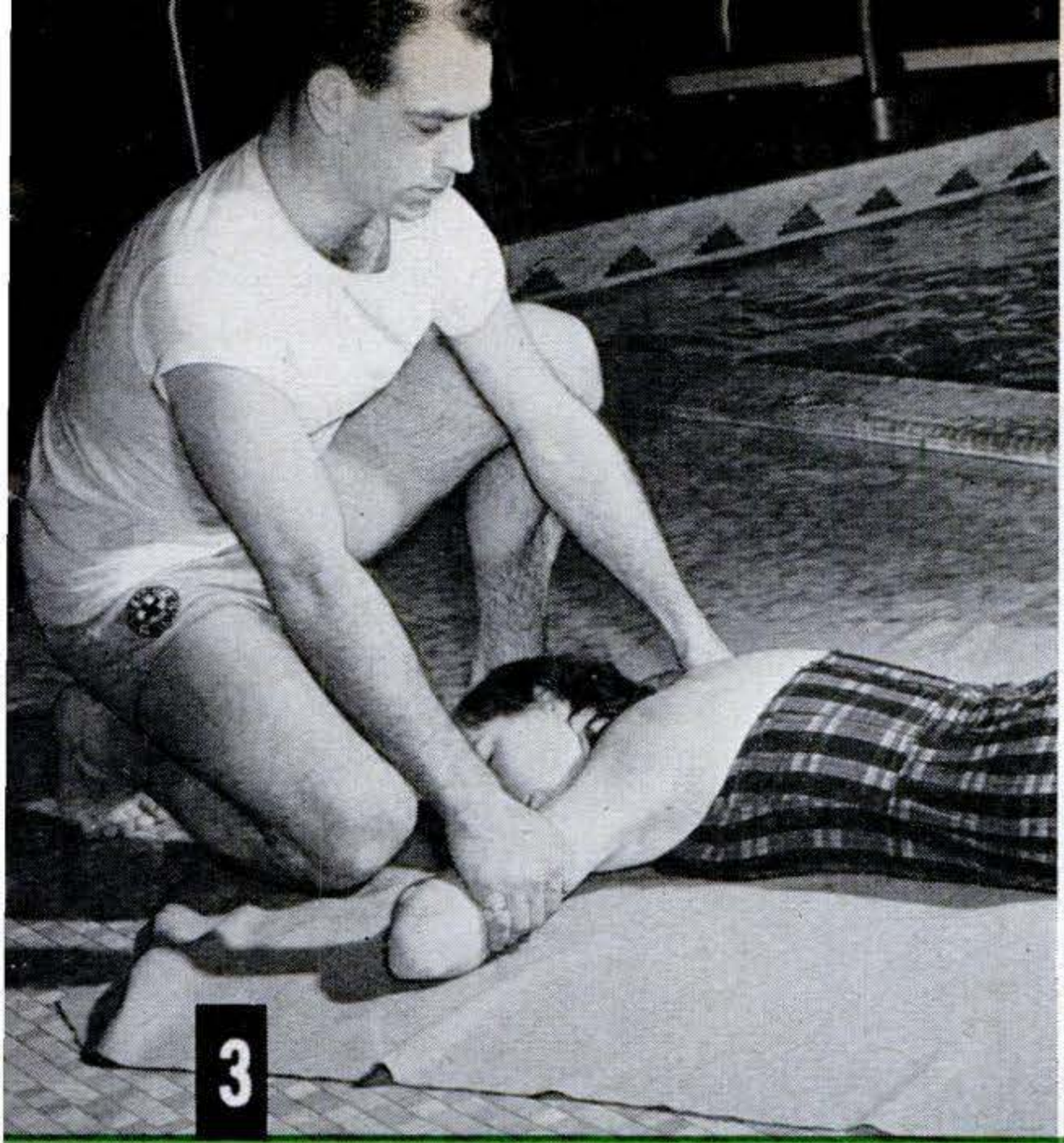

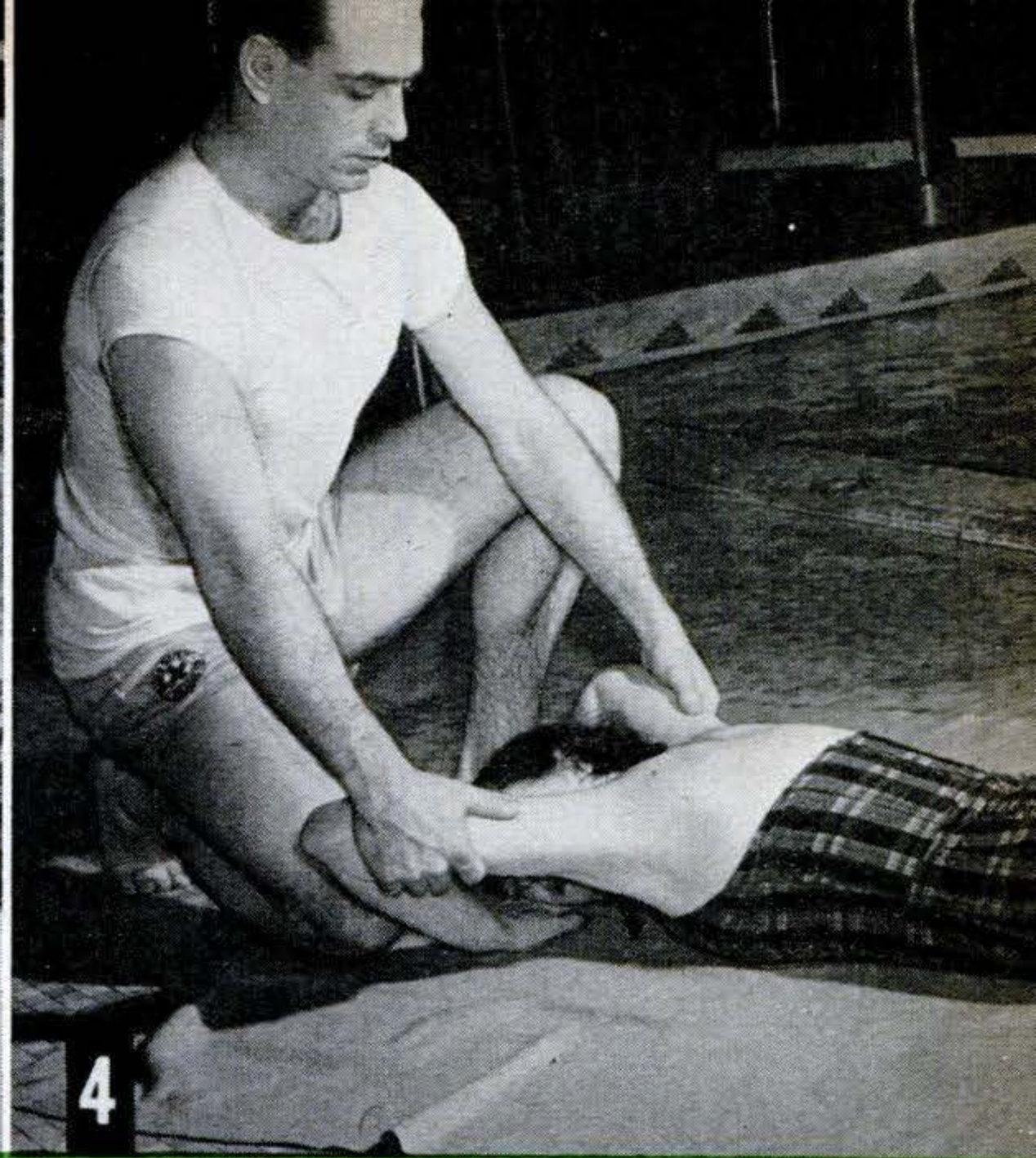

PULL: Operator then begins rocking backward slowly (3), sliding his hands to her arms just above the elbows. He raises her arms until resistance and tension are felt at her shoulders (4). Then he puts her arms back down. This completes the full cycle of Nielsen's artificial-respiration method. The cycles are repeated 10 to 12 times a minute, the pushes and pulls being of equal length and the release periods of minimum duration.

Makes Lifesaving Easier

of how scientists worked to get the bedrock facts about a problem that most people thought had been settled long before. Their work was spurred by the possibility of a war in which the enemy may use nerve gas. For, like curare, nerve gas can paralyze the muscles, including those used in breathing.

Nielsen perfected his method when he was 66, after a career as soldier, athlete, swimming coach and physical-training instructor. His father was a musician in Copenhagen, but the boy, entering the army, got interested in sports and at the first of the modern Olympics, at Athens in 1896, carried off second places in pistol shooting and in fencing with sabers. Two years later he became chairman of the Committee for Physical Exercise and Sport in Schools and in 1910 he founded the Danish Swimming and Life Saving Association.

As a swimming teacher, Nielsen learned and taught the resuscitation method then in widest use—the Silvester, named for the English physician who had developed it in 1858. In this method the victim lies on his back and the operator presses on the abdomen and then raises the arms. First, though, he has to spend time cleaning the patient's mouth, and he must keep on checking to see that debris and the tongue aren't choking off the airway.

Schafer Method Uses Push Only

When the much simpler Schafer method —developed by another English physician in 1903—came along, Nielsen enthusiastically took it up, but many authorities hesitated. The new method called for the victim to be placed face down, so it was easy to keep his throat clear, and all the operator had to do was press rhythmically on the lower ribs of the back.

But, the objectors pointed out, Schafer's was only a single-action method. It pushed air out of the lungs and then relied on the elastic recoil of the muscles and the internal organs to pull fresh air in. The Silvester

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method, on the other hand, was double action: pressure on the abdomen pushed air out, and raising the arms pulled air in.

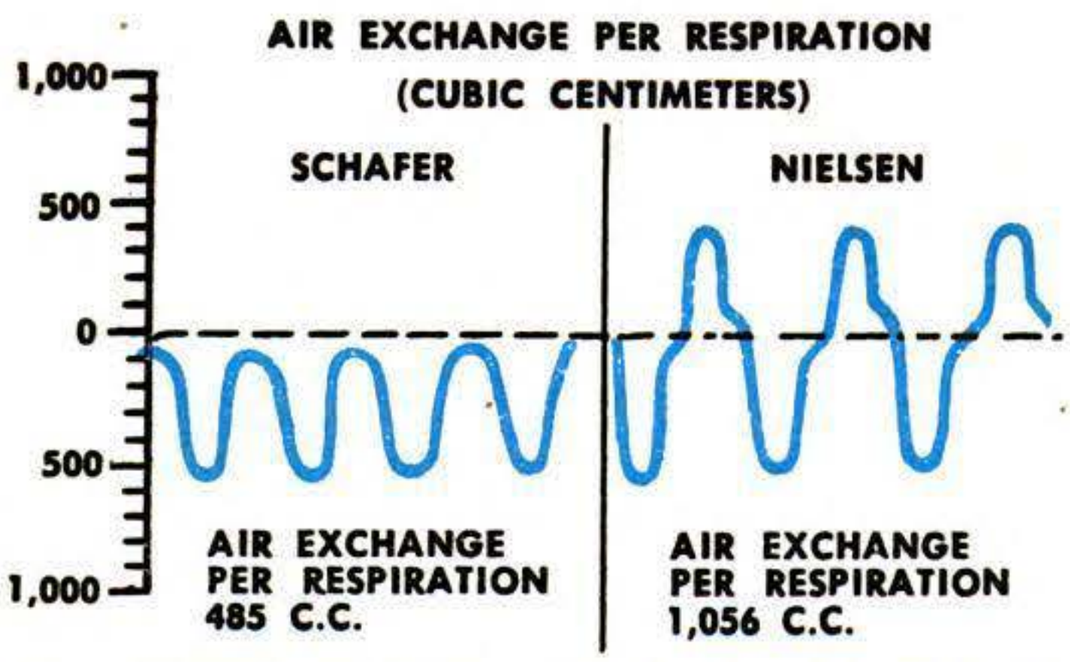
Nielsen went to work to see if the advantages of the two systems couldn't be combined. In 1931 he almost had the answer. The patient would lie face down, as in the Schafer method, and one rescuer would force air out of the lungs by pressing on the back, also as in the Schafer method, and then a second rescuer would help pull air in by lifting the patient's shoulders.

HOLGER NIELSEN, Danish inventor of recently adopted method of manual artificial respiration.

This two-man operation didn't satisfy Nielsen. One day he was lying face down on a table getting a massage for his rheumatism. The masseur stood at his head, placed his hands on his back, just below the shoulders, and pressed down. Nielsen noticed that breath was forced out of his lungs. The masseur repeated the pressure—again he felt an exhaust of air come out.

That was it—the solution. He immediately put his idea to test and found that one man could readily force air out by pressing on the back of the chest and then, by lifting the patient's arms, pull air in.

Nielsen asked Prof. August Krogh, Nobel prize-winning physiologist, to check this method. Then he described it in the Danish Medical Journal for December 15, 1932. The Danish Red Cross adopted it quickly, Norway in 1934, Greenland in 1937 and the Swedish Red Cross in 1939. But over here, as an American Red Cross official explained recently, "there was a vast amount of inertia."



AMOUNT OF AIR EXCHANGE obtained by Schafer and Nielsen methods is shown in chart above. Downward curves below the dotted line indicate amount of air forced out of lungs by each application of pressure. Upward curves in Schafer method show air pulled in by elastic recoil of muscles. With Nielsen method, pulling of arms by operator actively draws additional air into the lungs as shown by upward curves above the dotted line.

In 1945, a few doctors began moving against this inertia. Among them were Julius Comroe and Robert Dripps of the University of Pennsylvania School of Medicine, who tried two methods of artificial respiration on two hospital patients who had stopped breathing—one after a head injury and one after rupture of a brain abscess. The results showed "the complete inadequacy of the Schafer method."

People trusted the Schafer method, the doctors reported, simply because it worked very well when demonstrated on healthy persons who had voluntarily quit breathing. But there was evidence that it could get very little air into the lungs of corpses, and a person who requires artificial respiration "resembles a fresh cadaver more closely than he resembles a normal, healthy subject."

Too Painful in Polio Cases

In 1947 the American Red Cross—largely at the urging of Dr. Carl J. Potthoff, a youthful-looking M.D. who had become its Director of First Aid in 1945—asked the Council on Physical Medicine of the American Medical Association to study the problem. The Council reported that the Schafer method seemed inferior to several others but that more facts were needed. So the Red Cross granted research money to a group of doctors at the College of Medicine, University of Illinois, and in 1948-50 these men—Archer S. Gordon, Frank Raymon, Max Sadove, D. C. Fainer and A. C. Ivy—performed a series of experiments.

These investigators planned a series of tests on polio patients who could not breathe unaided. Patients at the Municipal Contagious Diseases Hospital in Chicago were willing, but the pain caused by the pressure on sore muscles was so great that the doctors decided to do their work with corpses.

[Continued on page 254]

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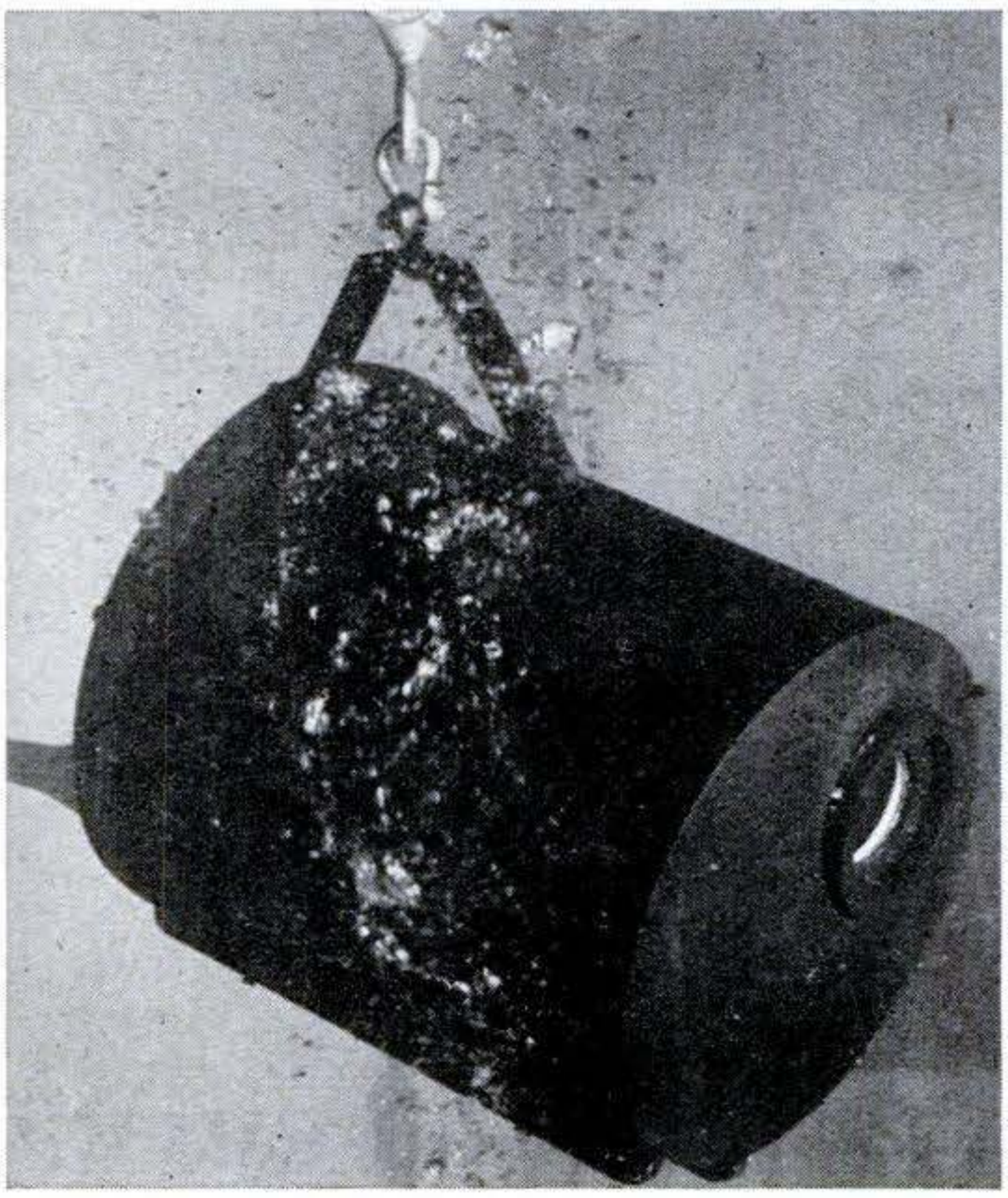
Navy Gets Turboprop Bomber

HERE is the U. S. Navy's first carrier-based bomber powered by turboprop engines. Called the North American Savage, its two Allison turbines whirl a pair of six-bladed propellers. It can carry five tons of bombs faster than 400 miles an hour. The armament consists of 20-millimeter guns. The wings fold.

Now being tested at Edwards Air Force Base in California, the Savage has a gross weight of more than 26 tons.



TV Camera Dons Diving Suit

IF THIS new TV camera, now undergoing tests, comes into general use among oceanographers, they will be able to observe life in the ocean depths without stirring from the comfort of a ship's cabin. The camera has a special pressure casing so that it can operate under water.

Photo above shows the camera, designed by Marconi Wireless Telegraph Co. of England, being lowered into a test tank.

Atom Fuel Comes in Cans

KNOW what the fuel for an atomic furnace looks like? It comes in the form of aluminum-jacketed uranium slugs four inches long and about an inch in diameter. Each slug weighs about 2½ pounds. In the photo above a workman inserts the slugs in one of the many fuel channels on the loading face of an atomic pile at Oak Ridge, Tenn. They are fed in end to end, 39 to 54 slugs to a row.

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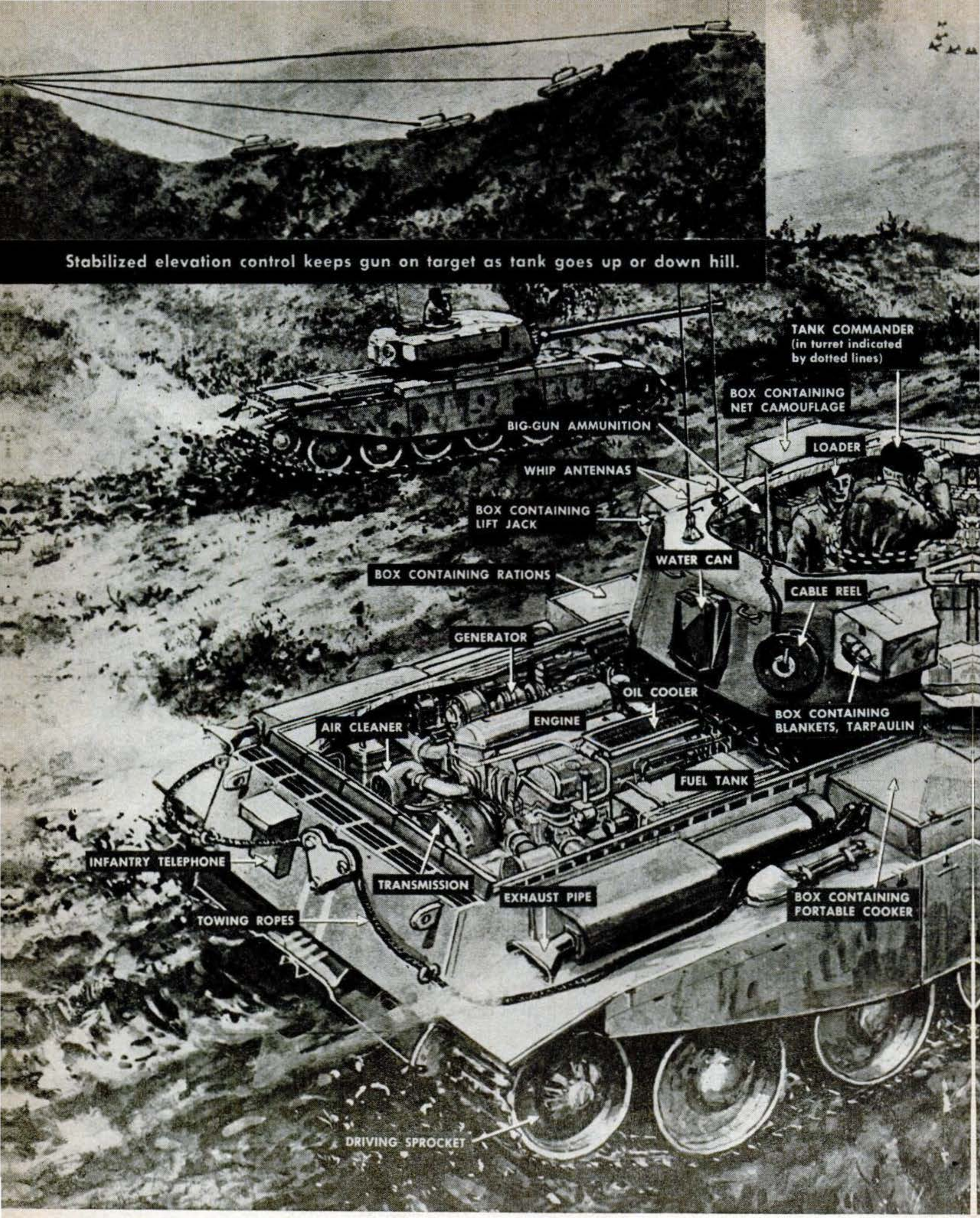

Big British Tank Aims on the Run

THE Royal Armoured Corps' new 48-ton Centurion tank, sketched in action by a British artist, is truly a land battleship: Like a warship's big guns, its rapid-firing 20-pounder (about 90 mm.) is automatical-

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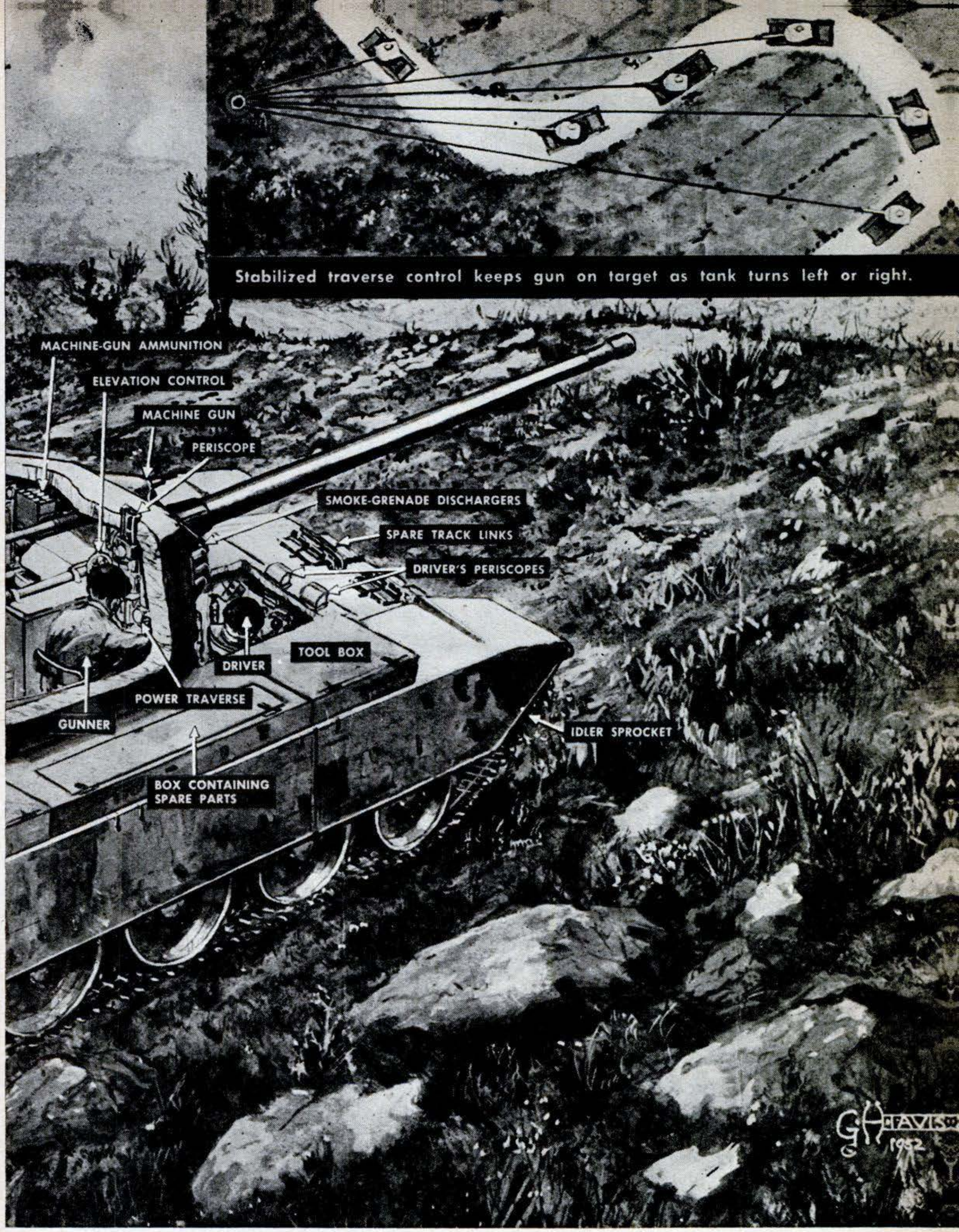

ly kept trained on target—no matter how the huge tank turns and bobs over rough terrain.

Successfully battle-tested in Korea, the Centurion also mounts a 7.92-mm. machine gun in its power turret, carries a crew of four and has a top speed of 20 m.p.h. Its hull is 25 feet long and 11 feet wide. The 12-cylinder engine develops 640 horsepower.

Not shown in the sketch: the Centurion's outlet for an electric razor.

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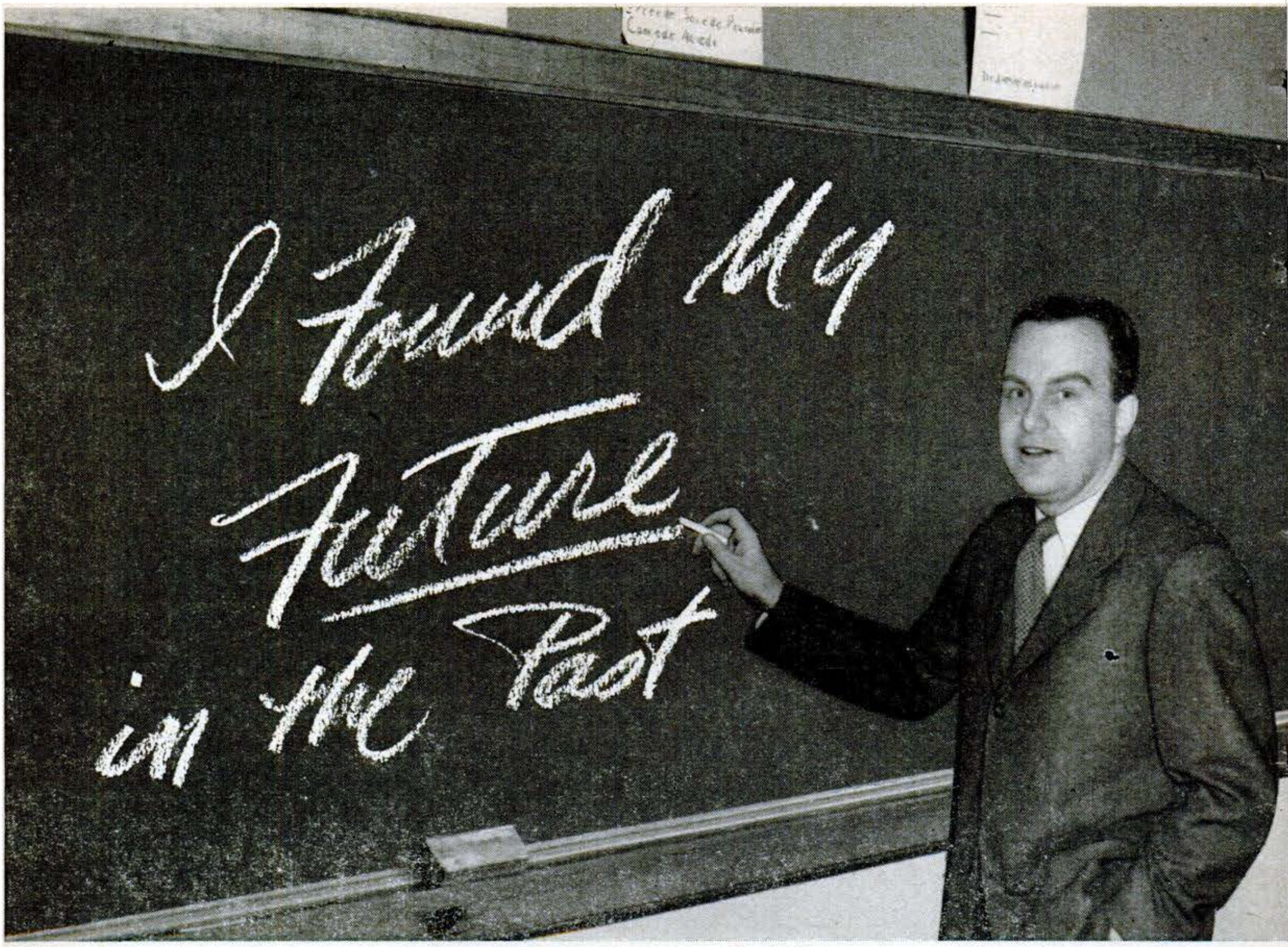

Oldtime blackboard—now a pleasing green—was first to get Bob Weaver's porcelain treatment.

Tough, handsome porcelain, as familiar as the kitchen sink, gave Bob Weaver the idea for a brand-new booming business.

By Lester David

"SOMEWHERE, somehow, the notion has been planted that a million-dollar business can blossom only from a brand-new, totally different, elaborately ingenious idea. Few young men realize they can bang the jack pot just as resoundingly with an *old* idea, adapted to modern needs."

So says Robert A. Weaver Jr., and he ought to know. At 34, he heads a company doing business at the rate of $1,500,000 a year. And this is the remarkable fact: In a little over four years, he built up this thumpingly prosperous firm by using something that has been kicking around since the dawn of civilization!

It's porcelain enamel, and it was used in one form or another by the great Chinese potters of the Sung Dynasty, by the ancient Egyptians and Assyrians, by the early Greeks and Romans. Porcelain enamel is a vitreous, or glasslike, composition applied to the surface of metal, glass or pottery for ornament, protection or as a basis for decoration. Actually it is a highly specialized field of ceramics.

Weaver latched onto the stuff and took a long, hard look at its qualifications: it is practically indestructible, resisting heat, cold, abrasion, water, chemicals and rust. Why, he asked himself, couldn't a lot more things be made of porcelain enamel besides the conventional stoves, sinks, store fronts and bathtubs? He could think of no satisfactory answer, so he went ahead and made them.

Among these bright new porcelain-enamel rabbits that Weaver pulled from his battered hat were:

- A "blackboard" for schoolrooms that gives off no glare or screech, won't scratch or

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break, has no pores in which chalk dust can accumulate, and, moreover, isn't black any more but a pleasing light green, soothing to children's eyes.

- A fireplace at half the cost of conventional ones, thus making possible their use in low-cost homes.
- Movie screens for drive-in theaters—they never need maintenance.
- A church steeple which requires no fixing or cleaning or any maintenance at all once it has been installed.

Wealth Was a Handicap

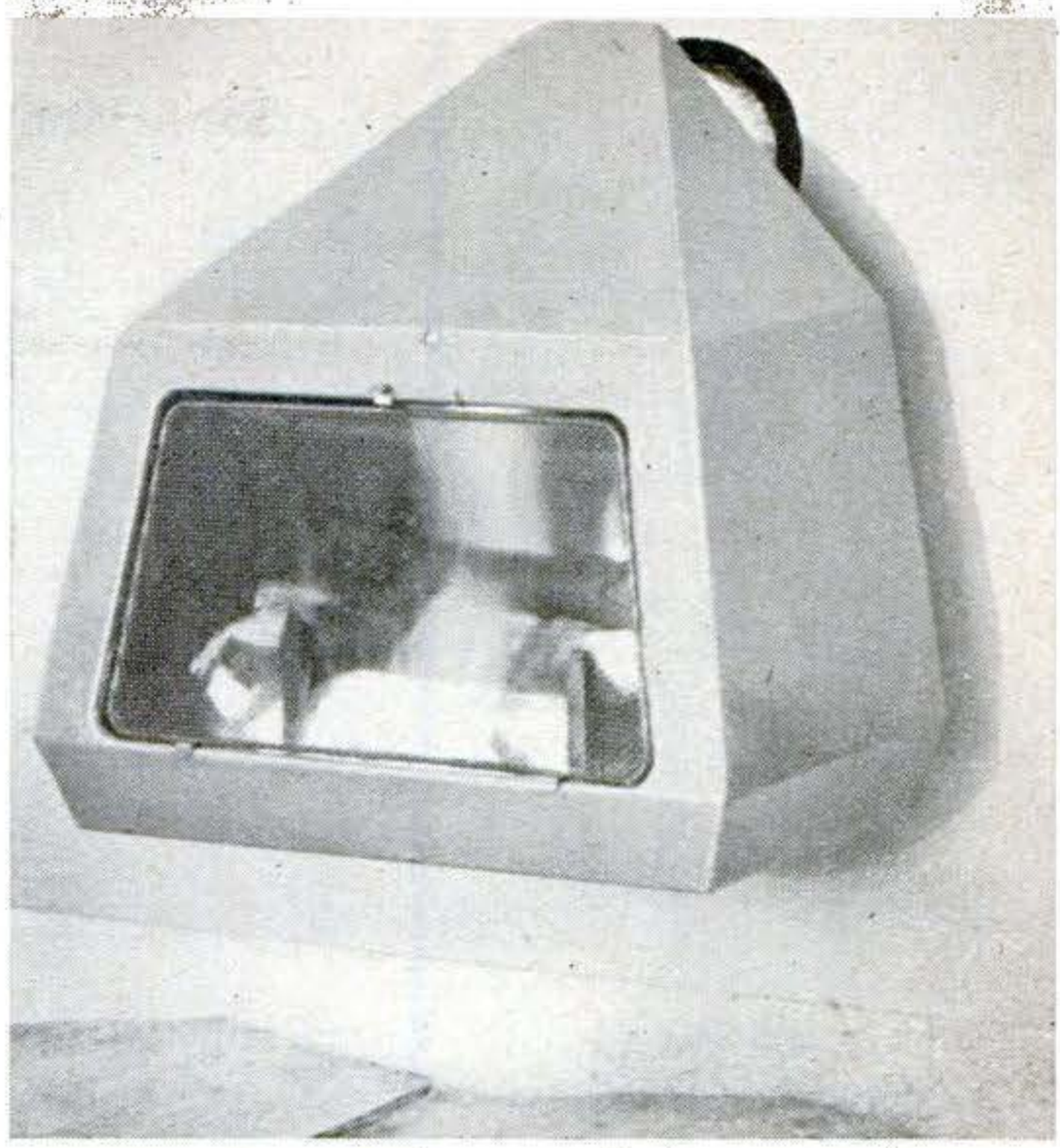
There are many more: colored window sills that last indefinitely and never need painting, reflectorized road and street signs for after-dark advertising and warnings, roof flashings and gutters in soft colors, coal and wet-cement chutes, chemical tanks, casseroles, tops for cocktail tables, coaster sets, and ash trays.

Weaver worked his way up in the business world despite a unique handicap—he had a rich father. Now ordinarily that wouldn't faze most people, but it presented an unusual problem for Bob because of a quaint notion harbored by Robert A. Weaver Sr. Dad had laid down a rule that no relatives could enter the family business. That the elder Weaver's business, the big Ferro Enamel Corp. of Cleveland, was large enough to accommodate a whole lot of relatives made no difference. He firmly believed that everyone should make his own way in the world just as he had.

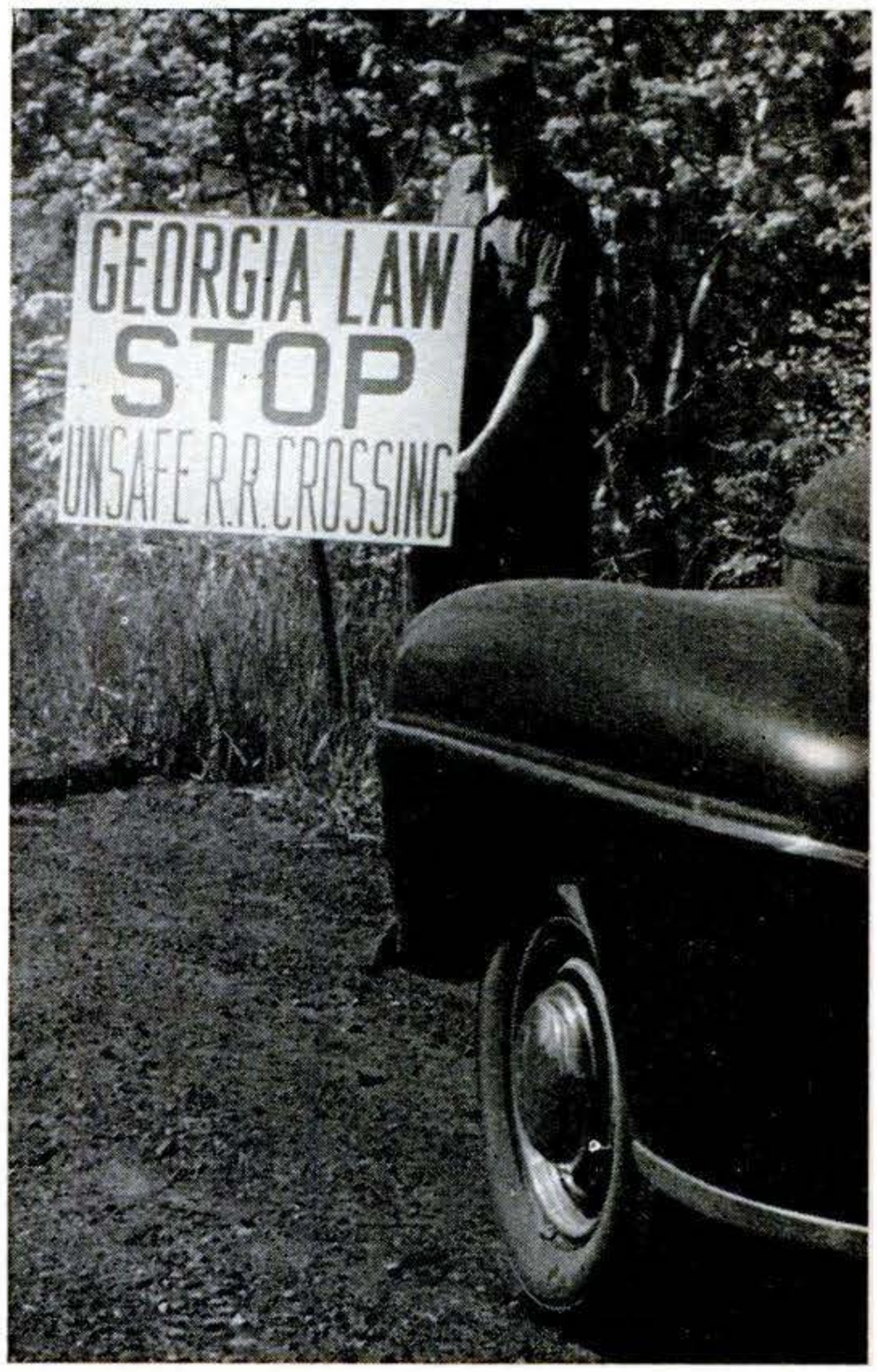
Small Factory Starts Big Business

So when Bob was graduated from Kenyon College in Gambier, Ohio, he hied up to Orillia, Ontario, and took a job in a ceramics factory. It paid peanuts and lasted a year and a half, or until the U.S. entered the war. Bob came back to the U.S., tried to enlist, was turned down because of an old back injury, then went right back to Canada and tried the Army up there in hope that maybe the Canadian medics would miss the defect. Sure enough, they did. At the end of the war in 1945, he looked around for something to do, along with a few million other ex-soldiers.

He looked for a whole year, then finally spotted a small, financially tottering, porcelain-enamel plant on the edge of Waltham, Mass. He found the Bettinger Co. He was convinced that the basic material Bettinger was using could be adapted to almost any



PREFAB FIREPLACE has tough, heatproof porcelain finish. Requiring only flue connection, it is easily installed in new low-cost homes or in existing houses that are without fireplaces.



REFLECTING ROAD SIGNS are rugged, weather-resistant and easy to maintain. Reflectorizing quality is permanently incorporated in porcelain-enamel coating and lasts indefinitely.

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product, for it was good, cheap, strong and decorative. It could be used in literally hundreds of ways in homes, office buildings, factories and on the streets.

So he emptied his small bank account, borrowed additional money and bought in. For two years he fought to revive the company and then, in 1947, the old management decided to call it quits. Weaver borrowed more money, bought the firm and stepped into high gear. He brought in two other young men, Frederick D. Shaw, a graduate of the Massachusetts Institute of Technology, and Arthur D. Shaver, a graduate of Harvard's business school. They knew that new products meant new business, so together they went after new and unique uses for porcelain enamel.

Like the blackboard. Carl Koch, an architect for whom Weaver had done some work, complained one day that he was having difficulties designing a modern school around blackboards which traditionally had to be dull black.

Architect's Problem Solved

Now people have been trying for years to make blackboards out of materials other than slate. They tried glass, but it broke too easily; they tried composition board, but it wore badly, scratched and was sensitive to damp weather. Weaver tried porcelain enamel.

Enameling sheet steel involves fusing onto its surface glasslike particles called frit. Weaver and his craftsmen worked for a year with various kinds of frit and different temperatures in the fusing process, finally coming up with a frit mixture which provided a surface rough enough to hold chalk. Next step was a visit to the National Bureau of Standards in Washington, where Weaver was advised to use a light green color. The new board, laminated on plywood, can be constructed in any size. It has already been installed in a number of new schools.

Or like the fireplace. Architect Koch was commissioned to design a group of low-cost homes and found that the budget did not allow for fireplaces. But homes are much more cheerful with blazes roaring on wintry evenings. So Koch came to Weaver, who told him:

"Go ahead and design a fireplace, any fireplace. If it's makeable, we'll make it."

Prefab Fireplace Cuts Cost

Up came Koch with a sleek, prefabricated beauty which could be attached to the wall or stood on slim brass legs. The Bettinger firm created it in Chinese red, ivory and black, and the total retail cost was $89—less than half the price of a stone or brick fireplace.

Or like the ceramic-coated parts that Weaver now makes for new Air Force planes.

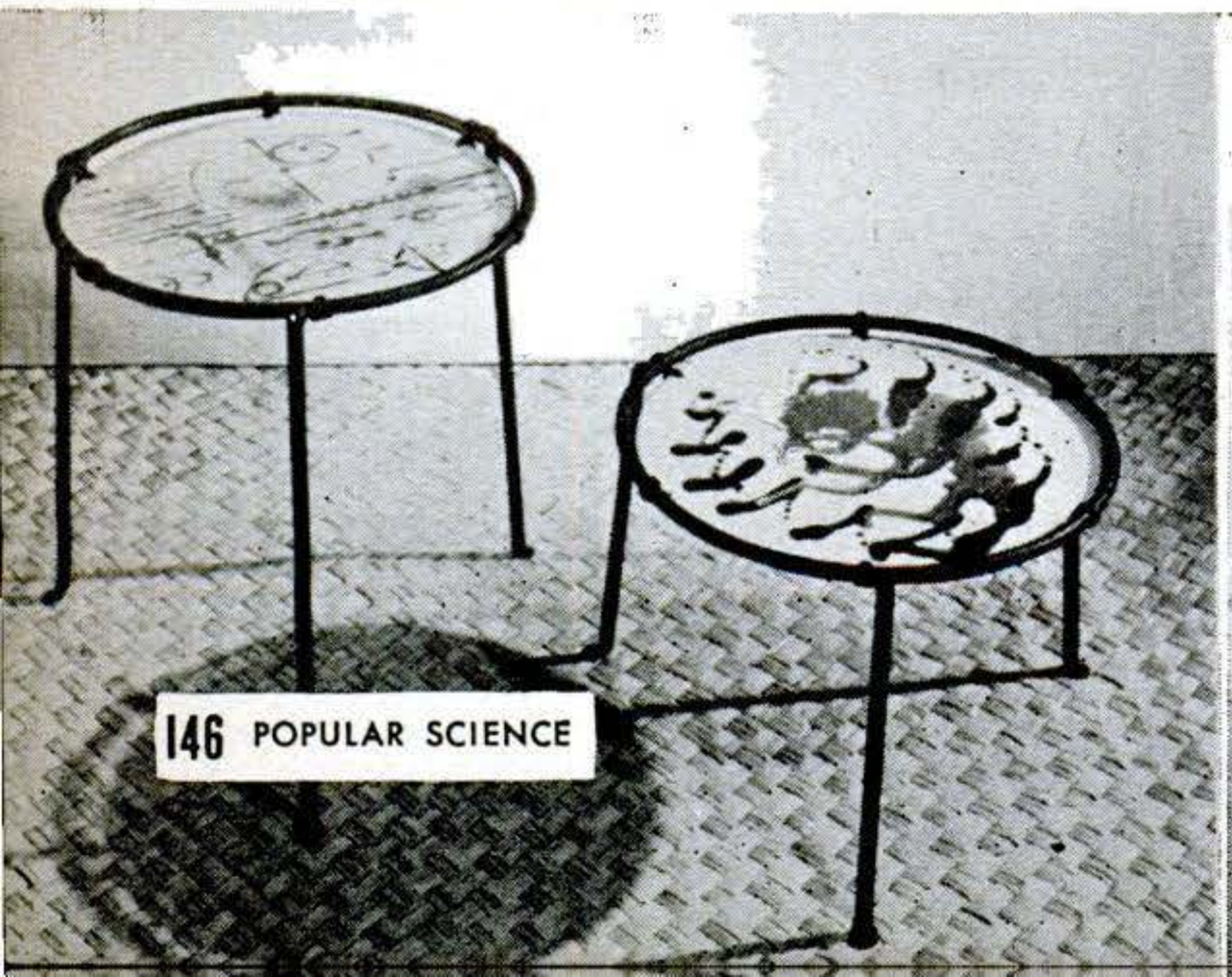
Jet and piston engines in military planes flying at high speeds generate intense heat. To resist these high temperatures, special heat-resisting alloys are used. But increasing flight speeds were pushing even these hot-spot metals to the limits of their capacity, and besides, stepped-up armament requirements exceeded the supply.

Air Force Gets Fast Answer

The Air Force put the problem up to the Bureau of Standards, which replied: "In theory, ceramic coating would give alloys a higher heat resistance, would give each part a longer life and scarce metals would be saved."

The Air Force then called in the General

DECORATIVE COCKTAIL TABLES have tops hand-enameled with porcelain in modern designs and then fired, come in many colors, sizes.



WINDOW SILLS for offices and schools, made of porcelain-enameled steel, won't mar or stain, need no painting and wipe clean with a cloth.

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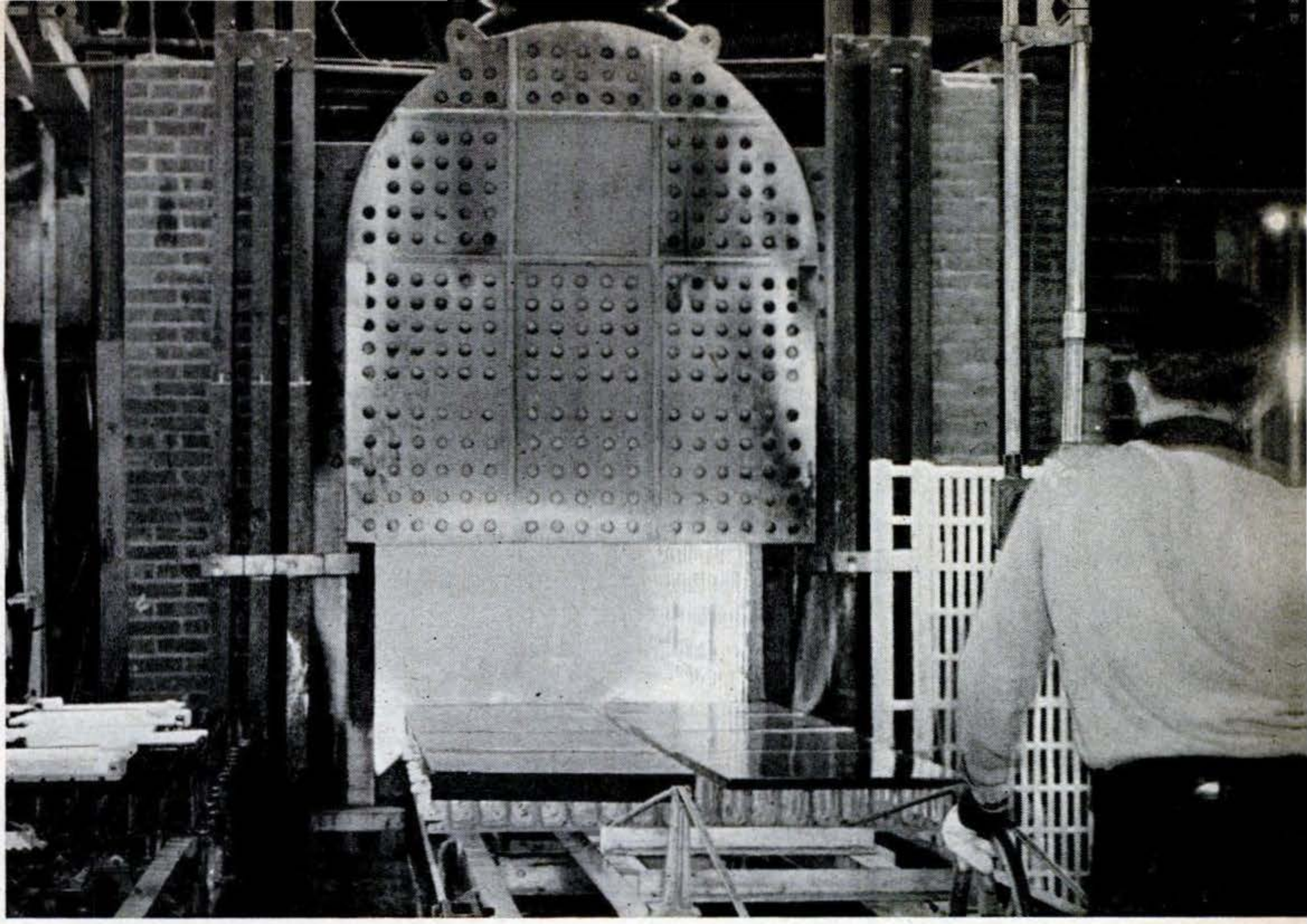


READY FOR FIRING, enameled panels go into big furnace at Bettinger plant in Waltham, Mass. Firing takes only a few minutes, permanently fuses porcelain to the metal.

Electric Co., which in turn called in Bob Weaver. But there was just one catch—the Air Force wanted the answer in exactly six weeks!

Weaver gulped, then went to work. Gambling many thousands of dollars, he built an entirely new small plant, invented and built the equipment, worked out the techniques, and six weeks from the day he got the contract he produced an answer which worked. The ceramic-coated parts are now flying in such planes as the B-36, the B-50, and the C-97.

Want to see how porcelain enameling is done? Take a short tour through the Bettinger plant.

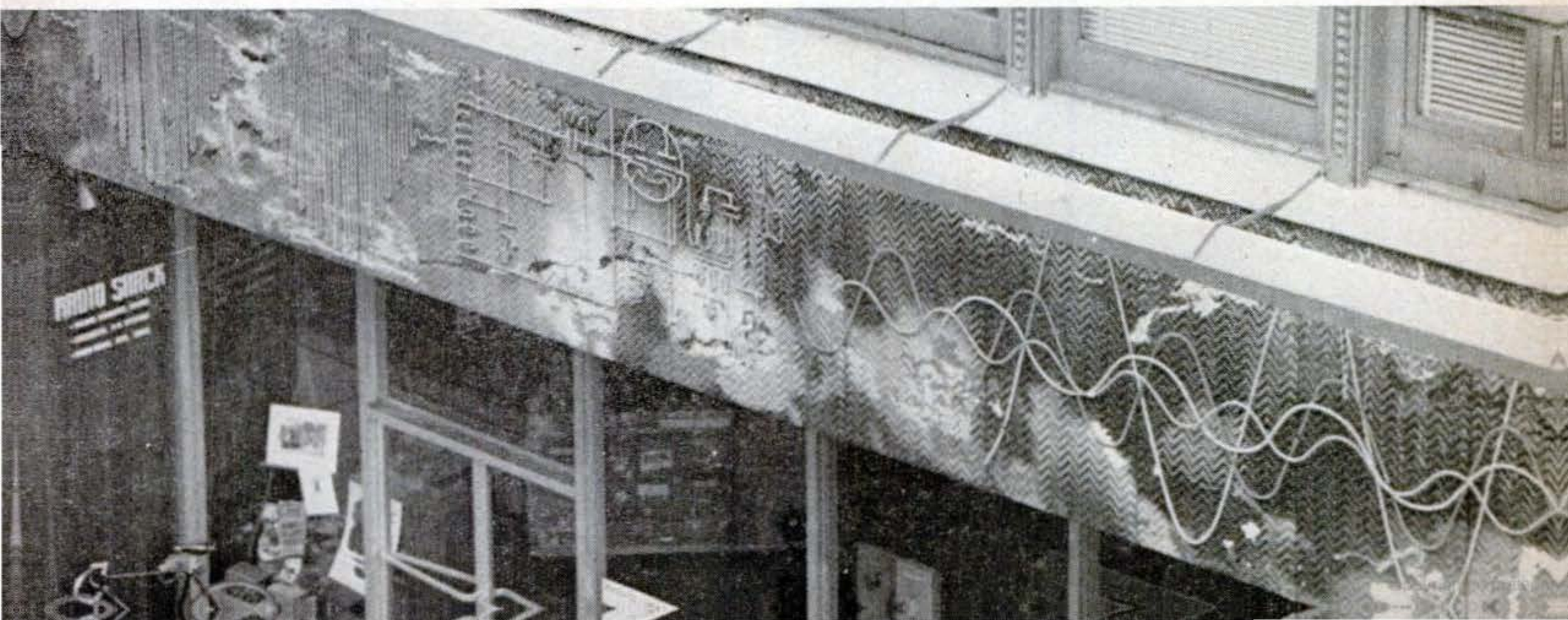
Three Basic Steps

First comes the preparation of both the metal and the enamel that's to go onto it. Metal parts must be carefully finished, all welded edges smoothed, and the surface etched in acid to remove the shine and make the enamel "take" more readily.

The enamel frit, a compound of special

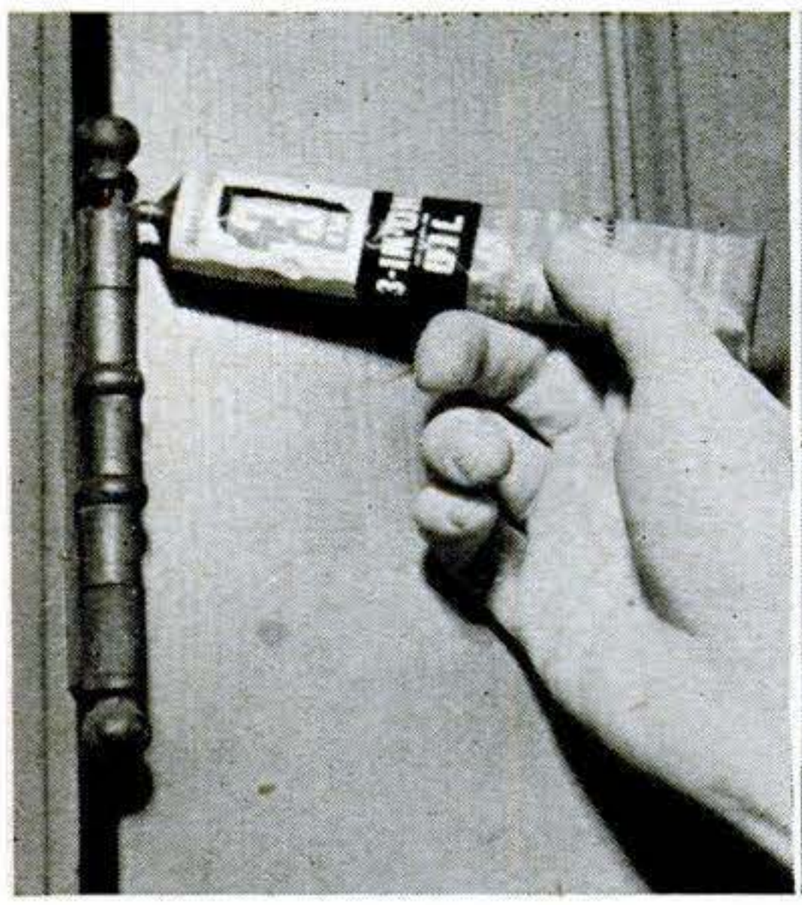
[*Continued on page 246*]

LAVISH SIGN for Boston radio store combines porcelain-enameled background in 15 colors with neon lighting. Designed by MIT color expert Gyorgy Keppes and made by Weaver, the easily fabricated sign gives old brownstone front a swank, modern look at low cost.

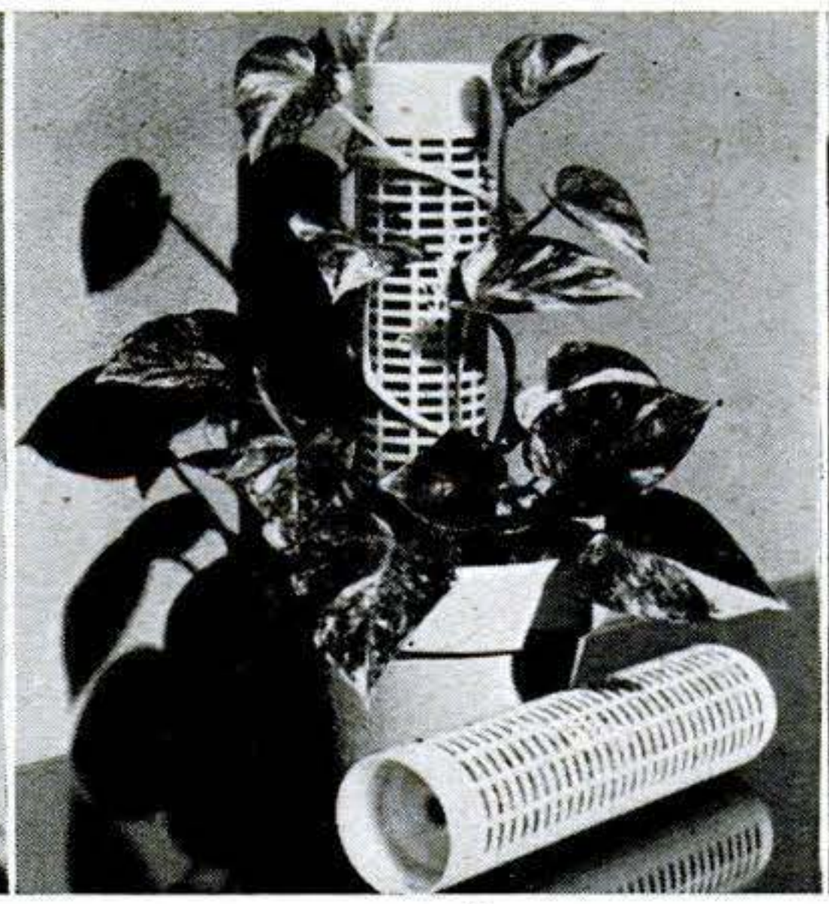


Aids to Modern Living

Triple-Duty Fan. Set in adjustable panels, this fan fits most double-hung windows. Reversing its position converts it from intake to exhaust. Removed from the window, it can be used as an air circulator. The hub of blade is mounted in rubber for quiet operation. Fan weighs 25 pounds. *Lau Blower Co., Dayton, Ohio.*

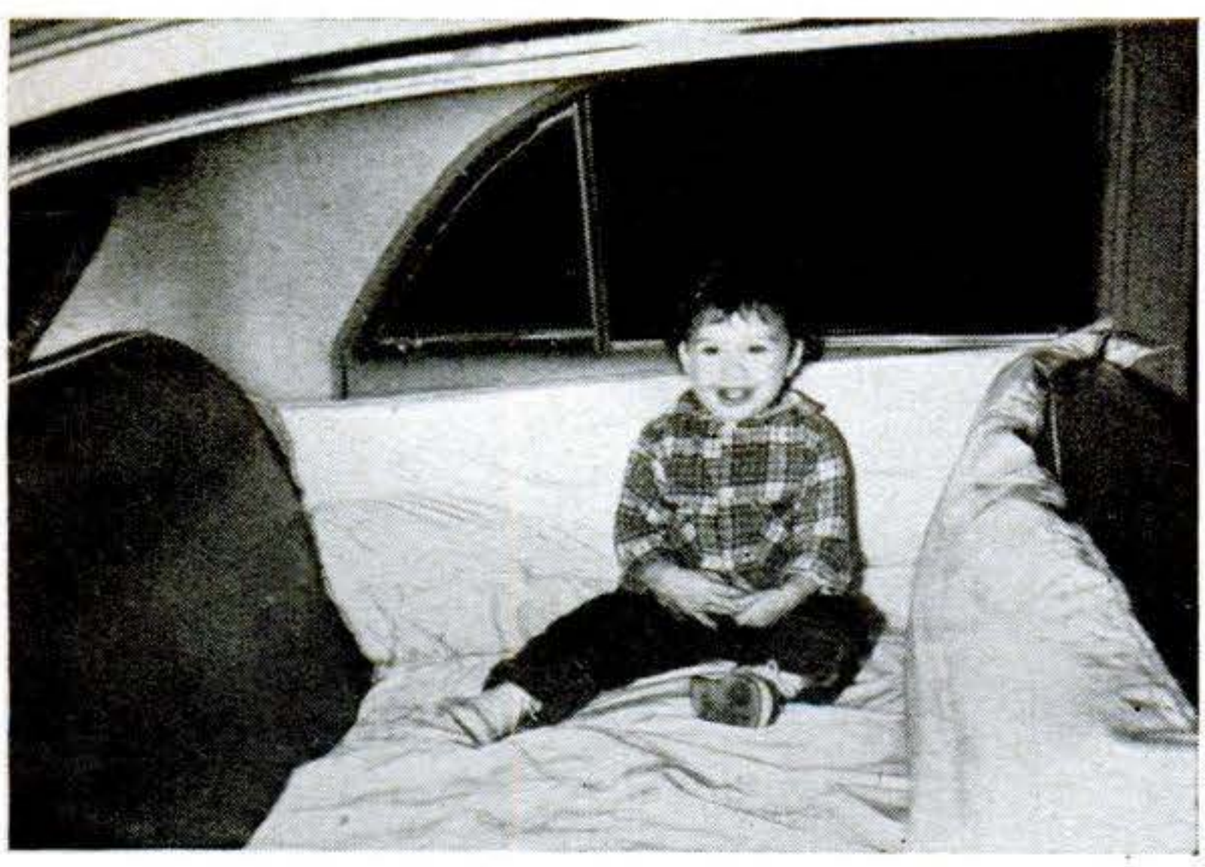


Oil in a Tube. Oil gets into the hardest-to-reach places when squirted from this handy spout tube. Both regular and heavy-body 3-in-One oil now come this way.



Plant Lattice. The gridded cylinder above, filled with sphagnum moss, provides support and moisture for potted climbing plants. *Parker Plastic Products, Houston.*

Cleaning Mitt. Slip soap into the pouch in this terry-cloth mitten and it delivers suds to hard-to-get-at spots. *United Novelties Mfg. Co., N. Y. C.*



Car Crib. This fold-away base and mat form a child's bed or play pen on a car's rear seat. *Progressive Enterprises, Los Angeles.*

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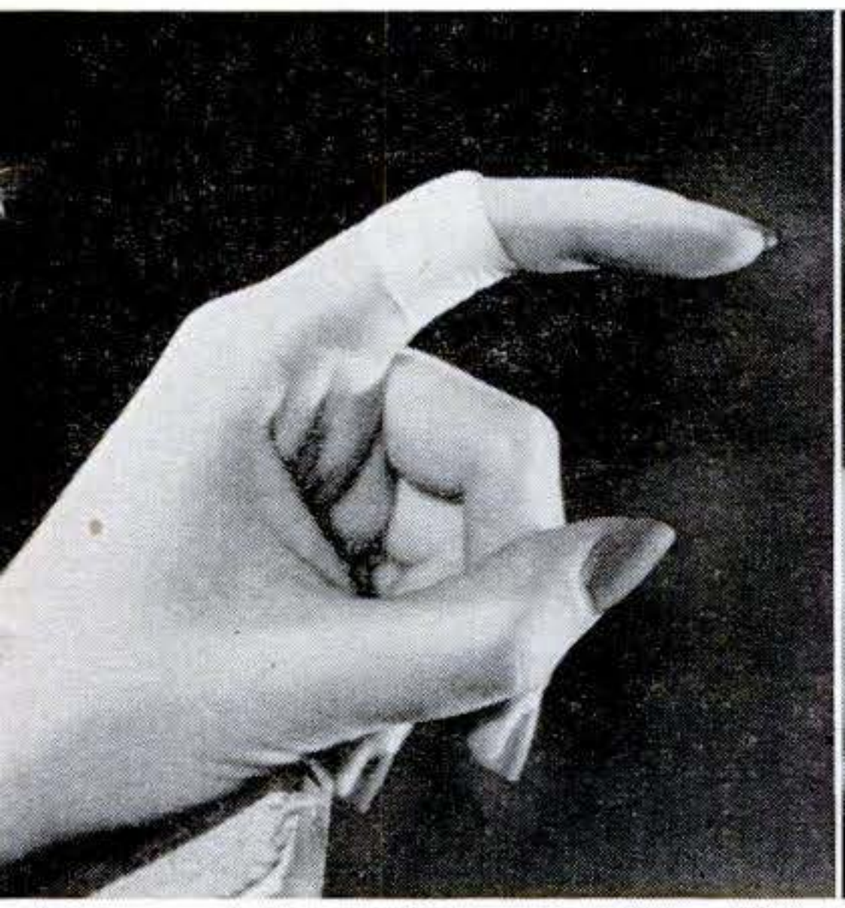
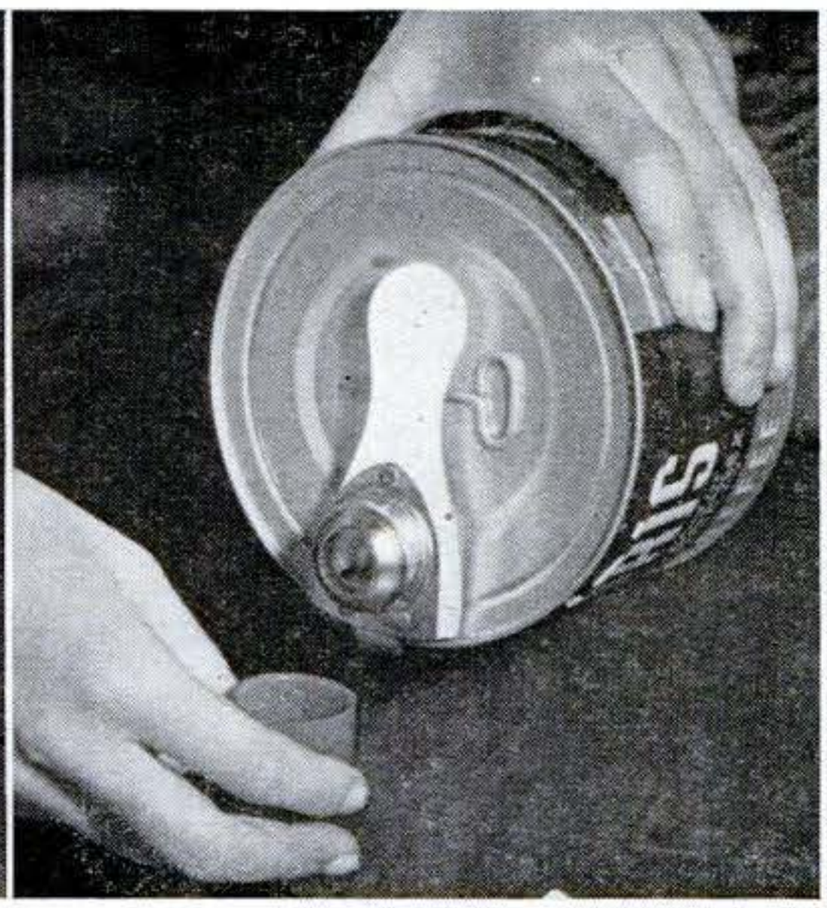
World Clock. Want to know the time anywhere in the world? A revolving disk on this clock tells you. Clock face in upper corner tells local time. *Kalex Corp., N.Y.C.*

Cold Lazy Susan. The stuff way back in the refrigerator is easy to get when stored on this revolving tray. It is also useful in pantry or sickroom. *Frigi-Tra Corp., N.Y.C.*

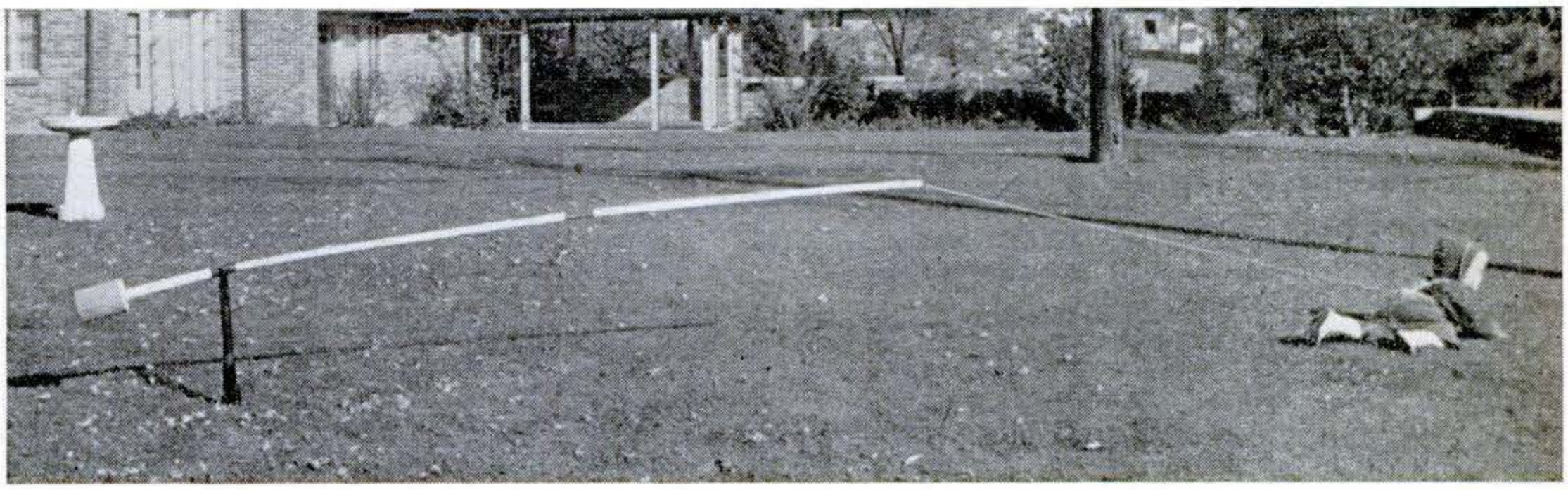


Elastic Bandage. This adhesive bandage conforms to every movement of your skin. A skin-like plastic, it can be washed. *Bauer & Black, Chicago.*



Coffee Tap. You punch a hole in a coffee can with this dispensing spout. The cap also serves to measure out the coffee. *Crosby Research Foundation, Hollywood.*

Ironing Pad. With this aluminum-foil ironing-board pad, you iron both sides of a fabric at once—it bounces back heat. *Farber & Greenberg, N.Y.C.*



Baby Hitch. Tethered to the weighted "fish pole" above, a baby can play unattended. The pole keeps cord out of child's way. *C. H. Baldwin Co., Lansing, Mich.*

Please turn the page for more aids to modern living.

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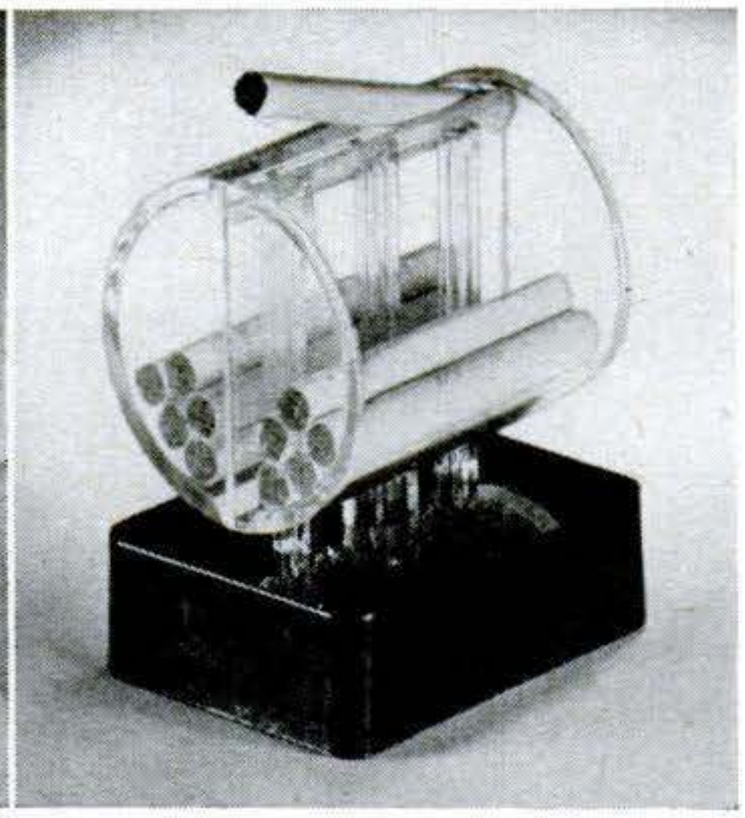
MORE Aids to Modern Living

Touch-Up Kit. This assortment of professional finishes will take care of scratches or burns on furniture, and chips in porcelain or enamel. *Northwestern Products, Minneapolis.*

Cover Lock. With the spring fastener above, a garbage-can lid is held tightly in place, but is easily removed by lifting straight up. *Tiidee Homemaking Projects, Dayton.*

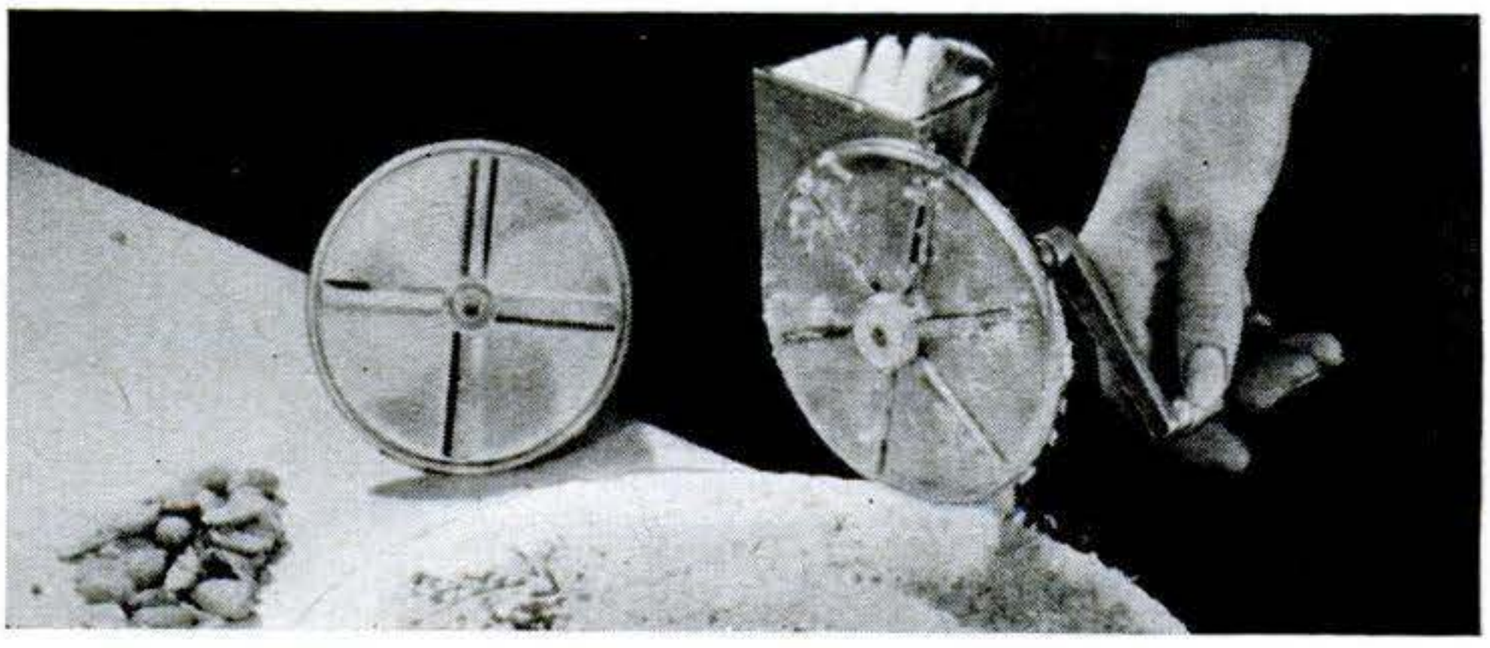
Lemon Cutter. Press down the blades and this gadget cuts a lemon into 10 wedges. *Kalian Products Corp., N.Y.C.*

Hose Coupling. One quick half-turn connects a hose to the faucet. *Hose-On Products, Burbank, Calif.*



Cigarette Box. Lift and release the barrel—a cigarette pops up. *Green-Moore, Somerville, Mass.*

Food Cutter. With this kitchen tool you can make your own potato chips, cut onions without crying, shred coconut or cabbage, or grind nuts. It attaches to table or counter with a wing nut, has two cutting blades. *Work Savers Industries, Farmington, Mich.*



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How to Help Build a House

By Arthur Bartlett

AN ATTRACTIVE housing development now nearing completion in Tappan, N. Y., is probably the nearest thing to a scientific test ever made of how much an average man can contribute toward the building of his own house. The answer is: PLENTY . . .

IF he makes sure he knows what he is doing before he does it.

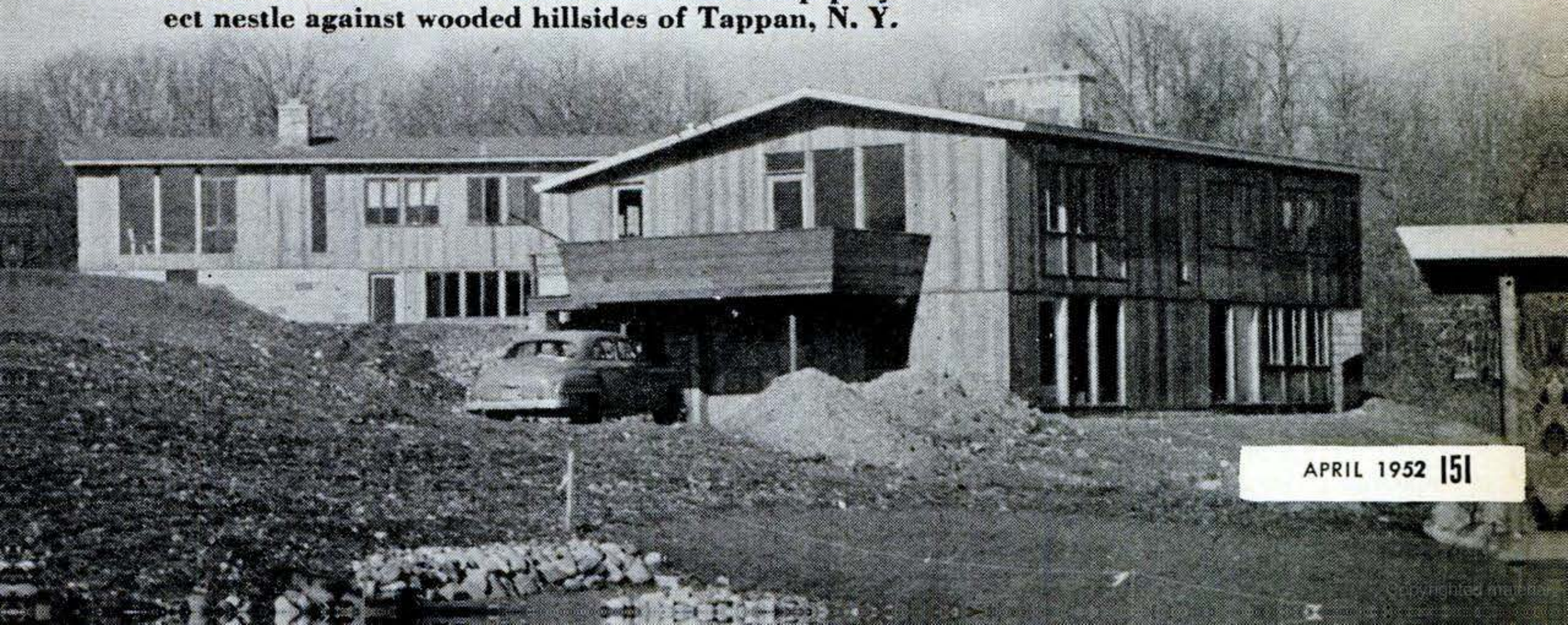
IF he fits his own work into an efficient over-all schedule which keeps the hired labor busy and progress steady.

IF he concentrates on jobs that he can do satisfactorily, and leaves the other jobs to experts.

In pioneer days, a man who needed a house just laid up four log walls and got the neighbors to help him put a roof over them. But that log cabin differed from a modern house almost as much as an oxcart does from a 1952 automobile. The man who has all the skills needed to build a house today is rare indeed. The average man has only a smattering of one or two of them, and sometimes is no more valuable around a house-building project than an extra thumb on a carpenter's hand.

At the Hickory Hill project, however,

HERE'S THE RESULT: Handsome homes of co-op project nestle against wooded hillsides of Tappan, N. Y.



white-collar men from New York City skyscrapers are now helping build 32 fine houses. About half of these houses have been completed and occupied. Work on the others is progressing rapidly and smoothly. The owners for whom these houses are being built have done at least 15 percent of the work. That is the conservative estimate of the professional builder supervising the project. Yet their skillfulness with tools, when the project started, ranged only from the level of a handy-man-about-the-house down to practically zero.

They Learned New Skills

Nor does this tell the whole story. They were their own contractors (not individually, in this case, but as an organized group). That, they believe, has saved even more than the actual construction work they did themselves. And in virtually all cases, they have left certain jobs, such as finishing off basements as recreation rooms, to be done leisurely by themselves later. Few of them would have felt capable of attempting such jobs unaided before they had increased their skill with tools by working on the main job of house building.

The size and scope of the Hickory Hill project, together with the number and variety of people involved, make it an almost ideal measuring stick of the average man's usefulness in the building of a house. Many a man elsewhere, of course, has pitched in and worked on his own home. But these men went about it with organized schedules and records, with an almost academic zeal to evaluate their own work. They have learned which parts of the job an ordinary fellow can do to the best advantage, and which he cannot; what sort of problems arise in the use of owner-labor, and how best to solve them.

Scientific Approach Pays

They undertook all this, of course, because they wanted the best houses that they could get for the money that they could afford to spend. In 1946, most of the present Hickory Hill owners were living in a student-veteran housing project near New York called Shanks Village. They knew that they couldn't go on living there indefinitely and began thinking about houses of their own.

A serious-minded, scholastic crowd—several of them are Ph.D.s in subjects such as botany, chemistry and anthropology—their

A Check List of

✔ **FOOTING DRAINS.** Drain tile is laid around base of walls and led to dry well. Amateur can do this but should get advice.

✔ **INSULATION.** Only tool needed for this simple job is stapling gun to tack flanges of batt insulation to studs and joists.

✔ **SETTING NAILS.** Sinking and puttying nailheads takes more time than skill. At Hickory Hill, the wives did most of it.

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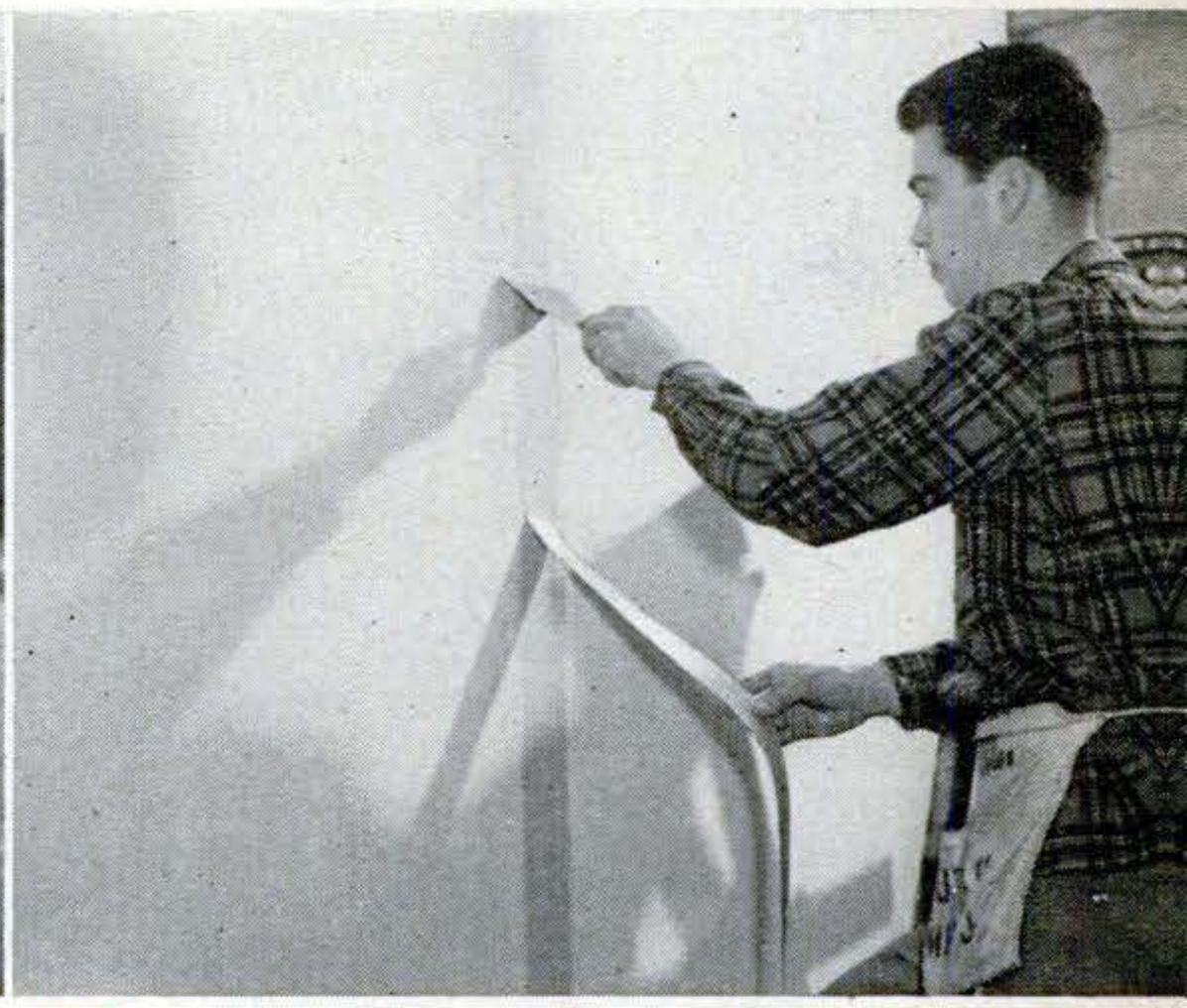
House-Building Jobs You Can Do Week Ends

WATERPROOFING. Building concrete-block walls is mason's job, but anyone can waterproof them with asphalt.

SHEATHING. Fiberboard goes on quickly. Members of group also put on roof sheathing and subflooring, laid asphalt-tile floors.

WALLBOARD. It takes skill to fit wallboard perfectly, but with a little practice anyone who can use a hammer can do it.

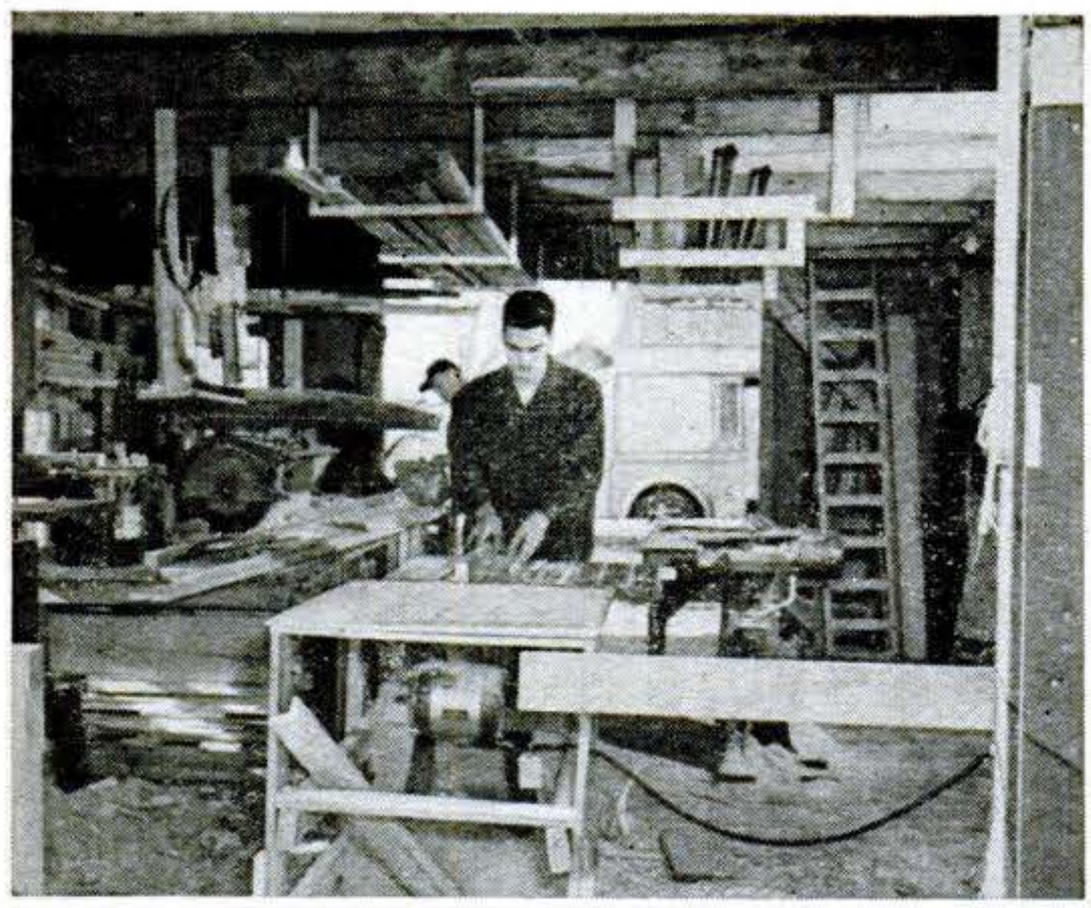


FILLING WALLBOARD SEAMS. Taping and plastering the joints is a time-consuming job that you can save on by doing yourself.

FINISHING WOODWORK. You and your wife can do it even after you've moved in. New types of natural finish are easy to apply.

PAINTING. You can save a nice dollar by doing your own painting, inside and out. A roller is faster than a brush on interiors.

IN CONSTRUCTION SHACK, Irving E. Kimmey (seated), construction superintendent, and Ed McAvoy, one of project members, check jobs that are ready for week-end work.



IN PROJECT'S SHOP, McAvoy fabricates a door frame. Shop has belt sander, bandsaw, two radial saws, table saw, portable saw, jointer, wood lathe and drill press.

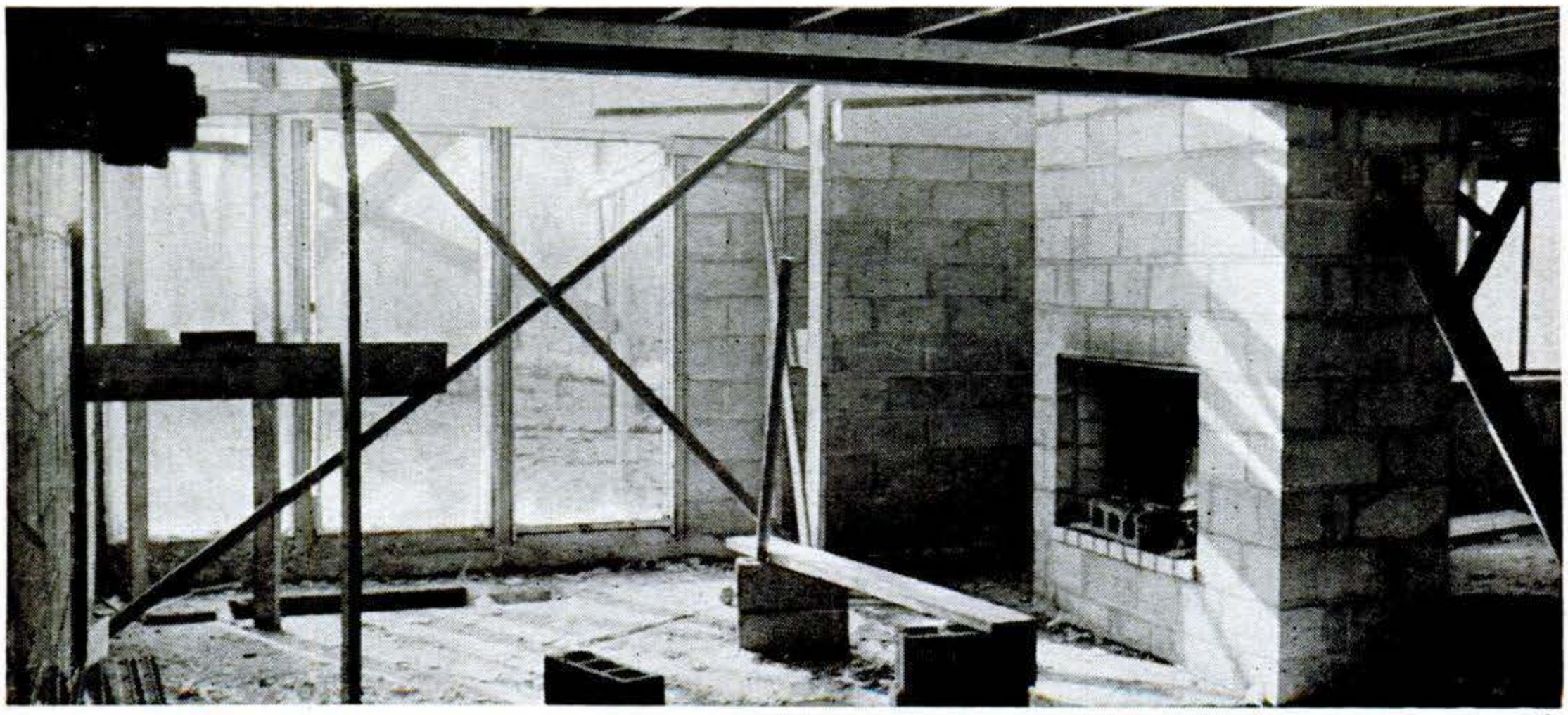
first step was to form a study group. An architectural student led the study of types of houses and developed a questionnaire on preferences and special requirements; a lawyer spearheaded an investigation of ways and means of organizing and financing a housing cooperative; an engineer led the attack on such problems as heating.

They soon made up their minds to form a cooperative and build houses for themselves, but they disagreed as to how the work ought to be done. Some wanted to try to do it all with their own labor. Some, at the other extreme, wanted to turn the whole job over to a contractor. Others urged the hiring of labor by the group, with the members contributing as much of their own labor as they could, and this was what was done.

Site with a History

The site that they chose consisted of 32 acres in the Hudson River valley. It was part of a hillside farm over which Redcoats and Colonials marched in the Revolution. They laid it out in 32 lots, averaging a little less than an acre, and set aside the balance—about two acres—for later community development. Then, in the spring of 1950, they hired a building superintendent and went to work.

The superintendent, Irving E. Kimmey, had been building houses around that area for years, and, as an Old Pro, he was not at all sure that having 32 owners around trying to work on the job was going to be any help at all. And they did make some costly mistakes.



SOME HOMES, like this one, have the living room in basement. Since all houses have full cellars with large picture windows, basements can be finished to give extra living quarters.

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One week end, for instance, a group of them decided to do some grading. They got the big bulldozer going and congratulated themselves on how well they were doing. Unfortunately, however, they ran it parallel to the newly laid foundations, thereby weakening the underpinning, and then piled too much dirt against them. Three walls gave way under the strain, and had to be rebuilt. That cost $1,000.

Overenthusiasm a Hazard

Another time they decided that one of the houses was ready for side sheathing and began putting it on. They did a neat job, but its value was considerably impaired by an oversight. The window frames had not yet been put in. So, when the regular carpenters came back on the job, the sheathing boards had to be cut away to get the window frames in.

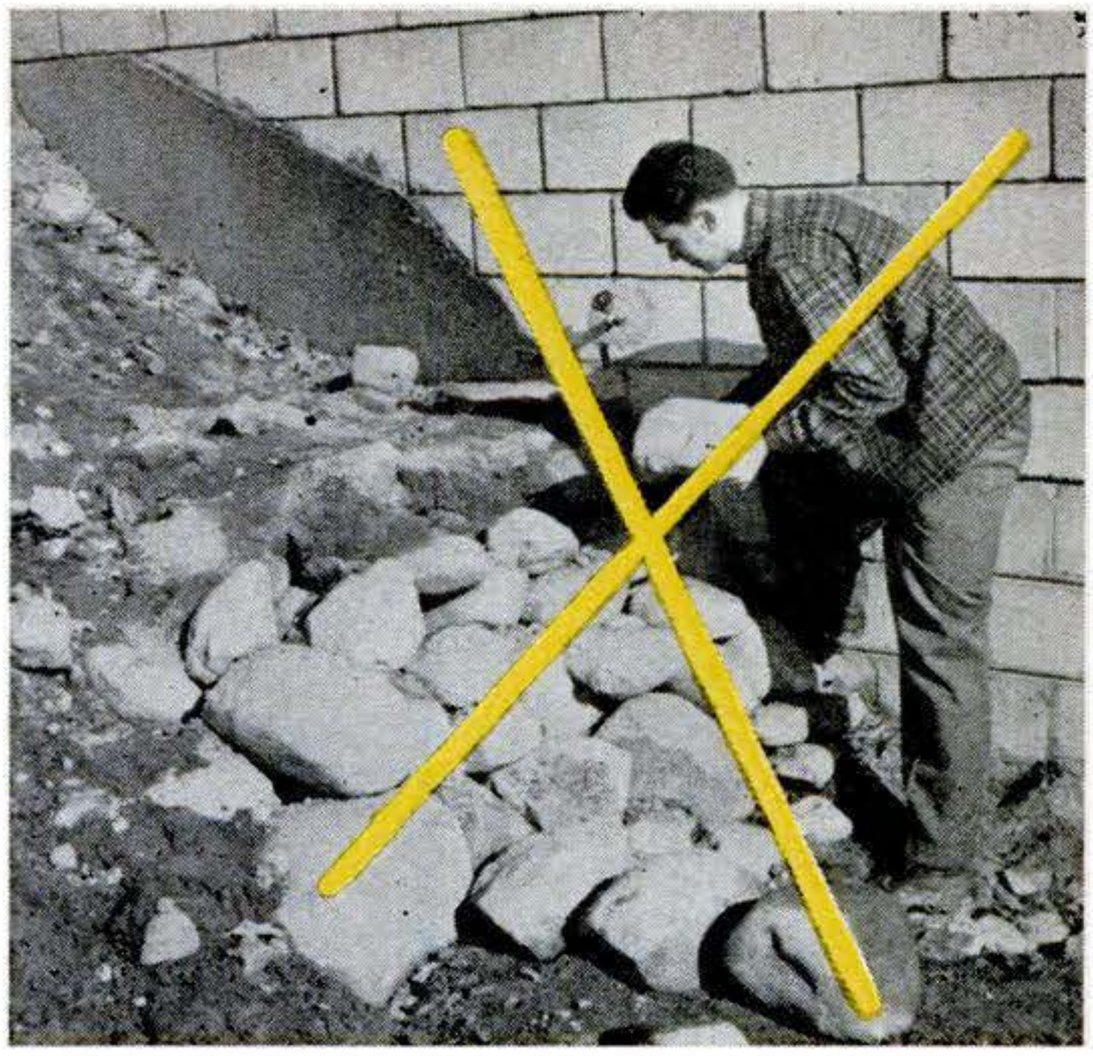
"They were just too eager and enthusiastic," says Superintendent Kimmey. He can talk about it tolerantly now because it doesn't happen any more. The first big *if* in the Hickory Hill investors' usefulness as spare-time owner-helpers was quickly recognized, and they took appropriate steps.

They already had a president (a philosophy professor) and a construction chairman (an anthropology professor), but the business end of the project kept both of them busy. So another member of the group was appointed supervisor of amateur workmen. He was a chemist but had grown up on a farm and knew more about construction work than most of the others.

Ledger Schedules Work

As a further protection against going ahead with the wrong job, they invented a novel ledger system. In the ledger, Superintendent Kimmey writes down on one page the jobs that are ready to be done when the week end rolls around; on the opposite page, the work supervisor, Wayne Maynard, later notes the corresponding work done.

Thus, on a given Saturday morning, Maynard may open the ledger to find that house No. 20 is ready for the finishing of interior woodwork, house No. 21 for insulation, house No. 22 for sheathing and so on; and when the week end's work is finished, he can present Kimmey with a record of just what has been accomplished on these jobs. This system has worked perfectly, and might well be adopted to advantage by anyone trying to contribute spare-



HEAVY WORK like this was waste of time, members quickly concluded. Day laborers could accomplish it more economically, leaving members free for semiskilled jobs.

time work to a house-building project.

This system also helps to minimize the second big *if*—the one pertaining to an efficient schedule.

Self-Help Didn't Work

On Hickory Hill this *if* proved to be so important that it led to a modification of the whole scheme. In the beginning, each person wanted, quite naturally, to work primarily on his own house. (Though the houses are built cooperatively, each one is financed by a GI loan, and its owner pays the computed cost of his particular house.) Each member of the group also agreed, however, to put in eight hours a week on *any* house in the development. This so-called group help—as differentiated from the self-help on their own houses—was meant to serve as a "cushion" between estimates and unforeseen costs.

The group-help plan worked out fine, but the self-helpers caused trouble. One man, for example, was going to install his own insulation. The house was ready for it on a Monday, but he couldn't do it until Saturday. So Kimmey had to stop all work on that house, call off the crew that was waiting to put up wallboard, and try to find some way to keep them busy on some other house. Such delays—and sometimes they were more serious—piled up costs.

Another lesson learned—the hard way—was that schedules must be maintained to

[Continued on page 244]

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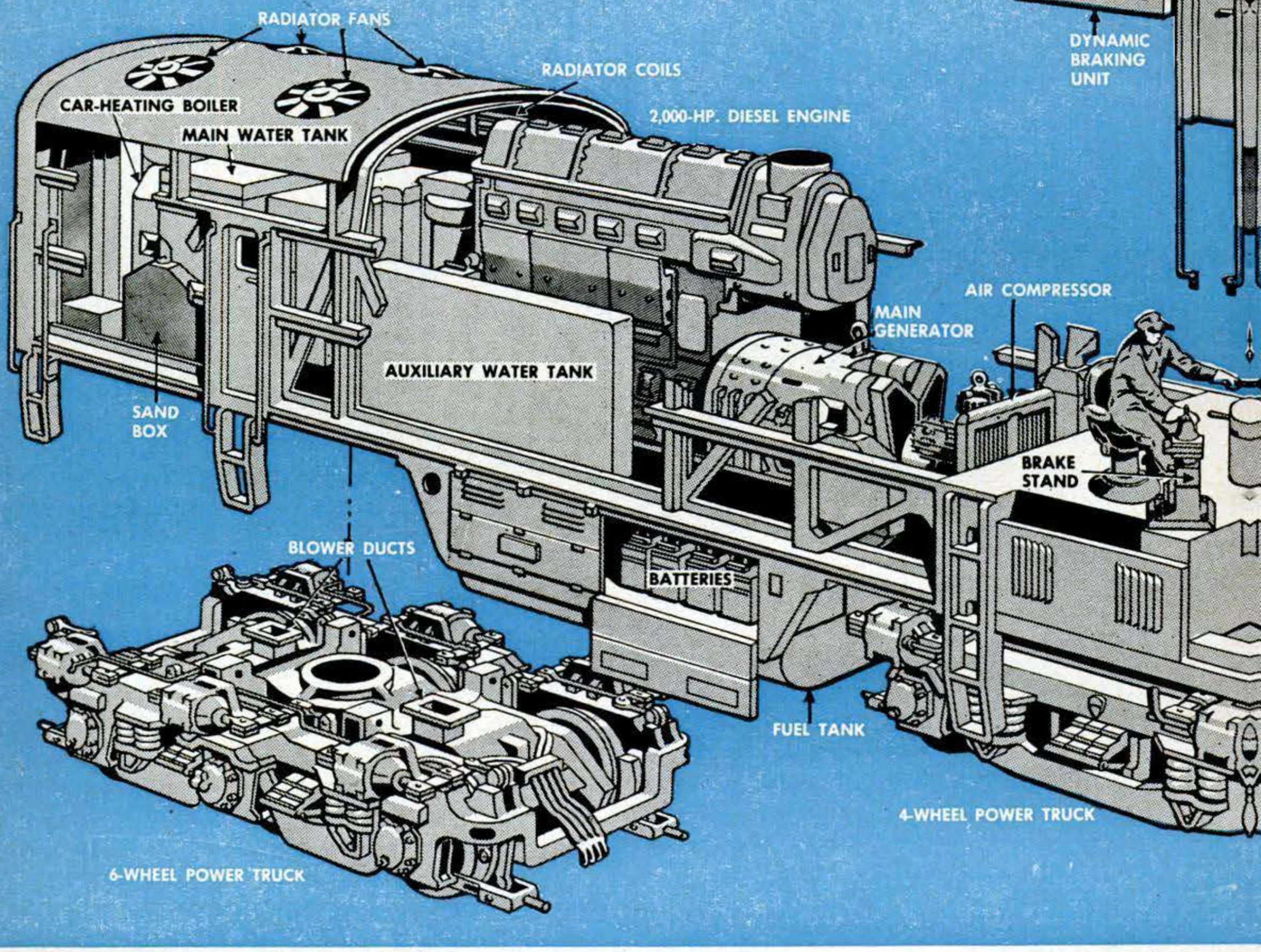
Are You a Diesel Detective?

This quiz will show you how to tell at a glance a locomotive's make and job.



MANY railroad fans boast that they can identify any Diesel by the sound of the engine. But there are easier ways to tell who made it—General Motors, Alco, Baldwin-Lima-Hamilton or Fairbanks-Morse. And if your eye is sharp, you can deduce from the profile what type of service each one performs. You can test your ability by studying the numbered drawings at right.

Here are some clues:

Numbers 1, 2, 3 and 4 are all designed to meet the same requirements. Each is rated between 1,500 and 1,600 horsepower, but is the product of a different builder.

Number 5 is basically the same kind of locomotive but its stepped-in flanks and two sets of cab controls adapt it to a different type of work. All four builders manufacture this line, but the rounded roof contours are peculiar to one.

Number 6 is actually two switching locomotives, permanently coupled together and controlled from a single cab. It is used in some of our largest rail centers. This articulated design is peculiar to one builder.

Number 7 is a 2,250-horsepower, two-engined version of a type made by all four manufacturers. Its bulbous nose identifies this one as a big brother of Number 4. The builders of locomotives 1 and 2 also turn out similar two-engined locomotives. The builder of No. 3 produces a comparable single-engined locomotive, which is shown in the exploded drawing above.

Now check your answers at right.—*Henry B. Comstock.*

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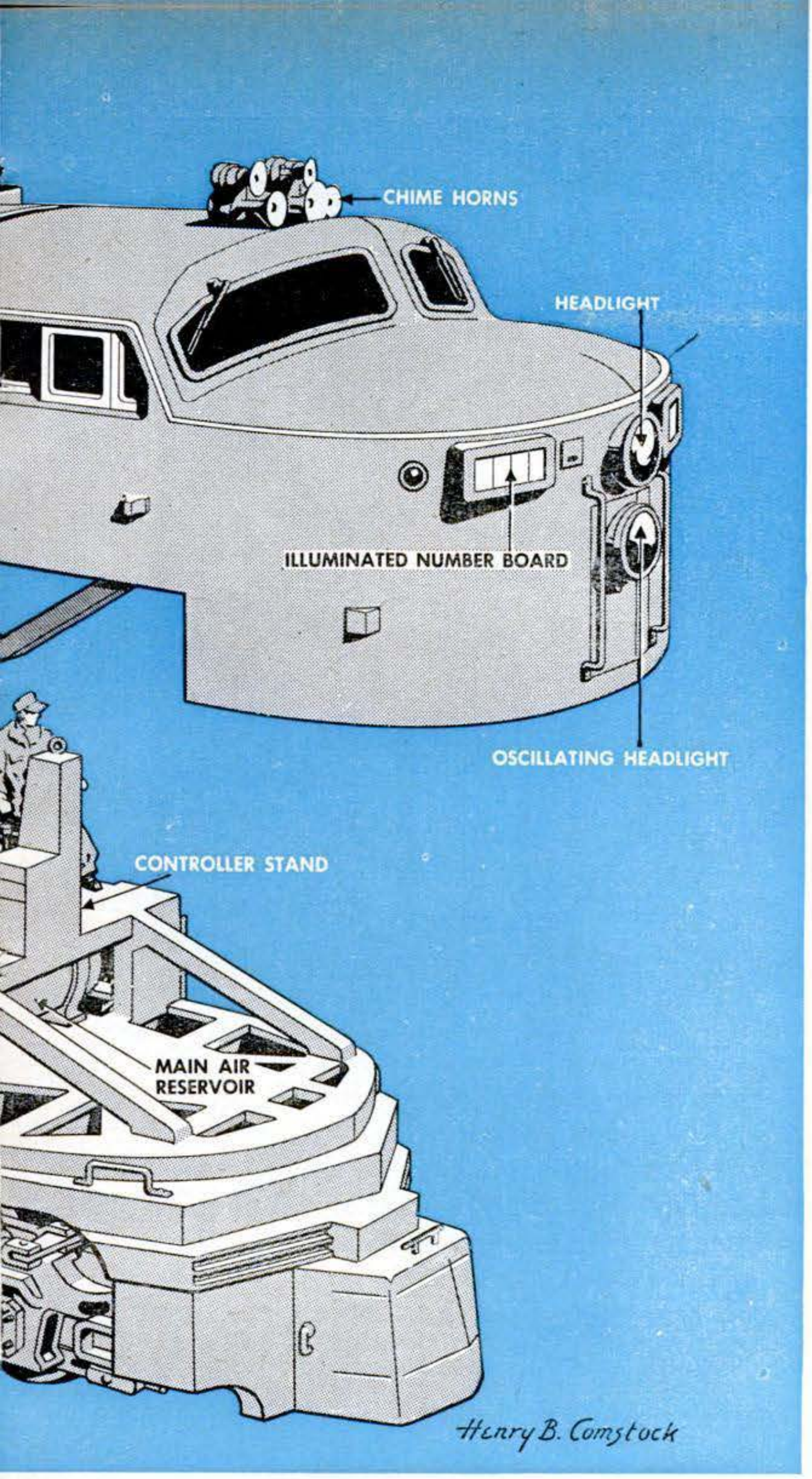
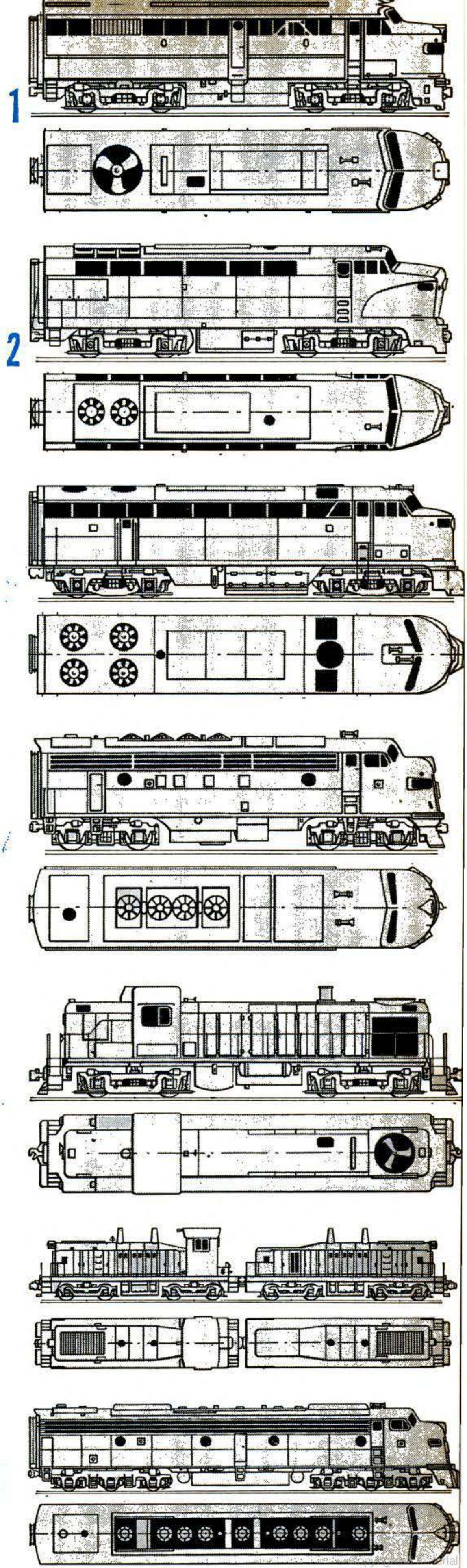




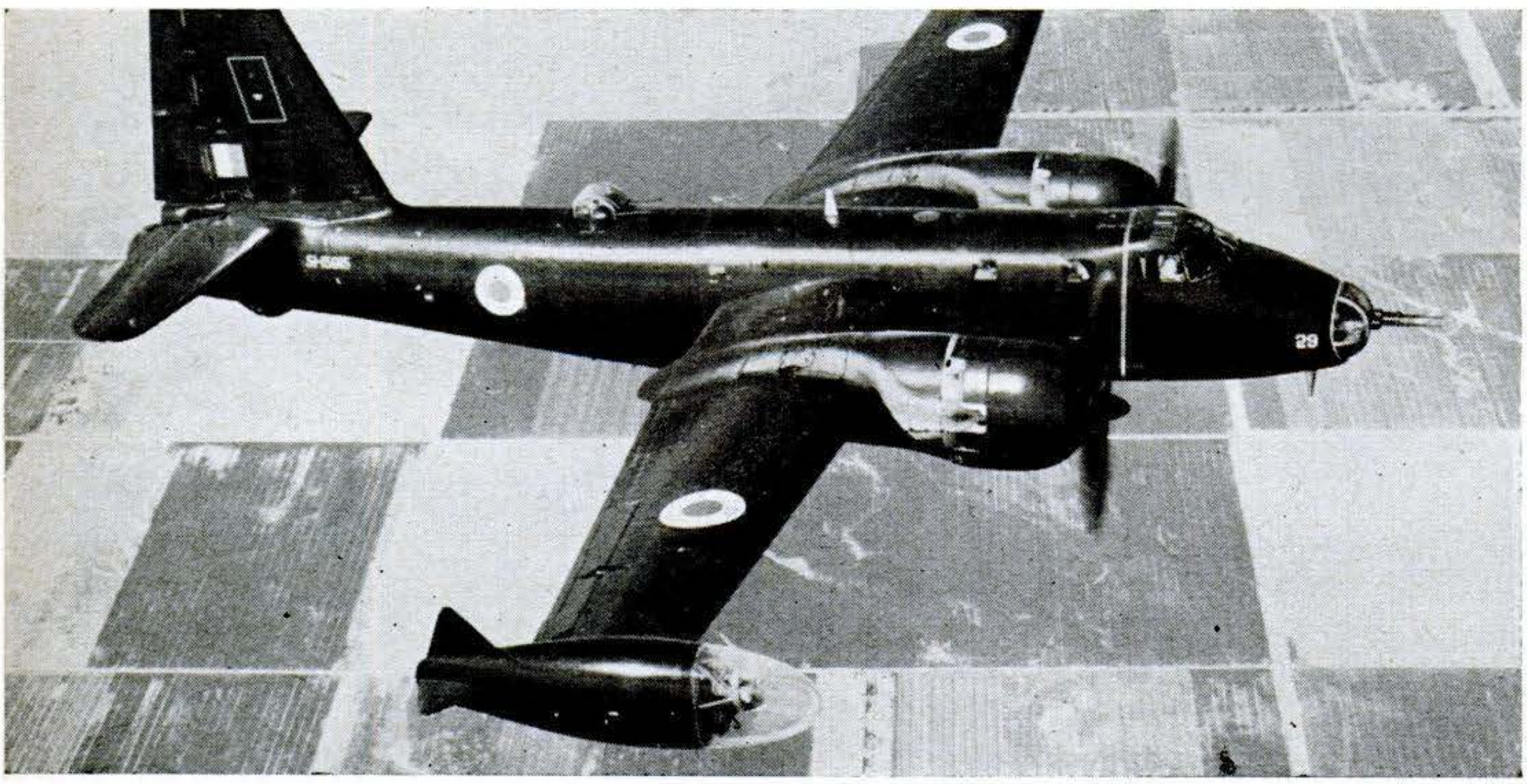
WHO'S WHO IN DIESELS

Numbers 1 through 4 are road freight engines. By the addition of a car-heating boiler and a change of gearing, they may be used in passenger service. The builders are—in order—Alco, Baldwin-Lima-Hamilton, Fairbanks-Morse and General Motors. Number 5 is an Alco road-switcher type, equally at home in yard service or out on the main line hauling a short freight or a commuter train. Number 6 is a GM transfer engine. Its specialty is assembling heavy freight trains and hauling them to another yard. Number 7 is a GM passenger engine, more powerful —and therefore faster—than the freight haulers. The large drawing shows the Fairbanks-Morse version of the same job, with a six-wheel truck at the rear.

THIS TUMBLE off a lift truck (right) is on purpose—a laboratory test to see how crate would take accidental drop in a warehouse. Officer examines recorder (above) in reopened crate. Test indicated crate would withstand sizable jolt without damage to contents.

Box 'Squeals' If Dropped

NOTE for freight handlers: The next time you get a box marked Air Materiel Command, take it easy. Hidden inside may be a gadget that not only makes a record every time you drop it or set it wrong end up, but even tells the time the mishandling occurred. The Air Force agency bought 15 of these Impact-O-Graphs, is using some for laboratory research and hiding others in regular shipments in an attempt to reduce breakage.



Searchlight to Aid Sub Hunting

A GROUND spectator watching a Lockheed Neptune flying over Los Angeles the other day spotted a mysterious plastic nose on one of the wing-tip auxiliary fuel tanks. Now the U. S. Navy has popped the secret. The Neptunes, used by the British for anti-submarine work, have searchlights for night flying in one of the supplementary tanks.

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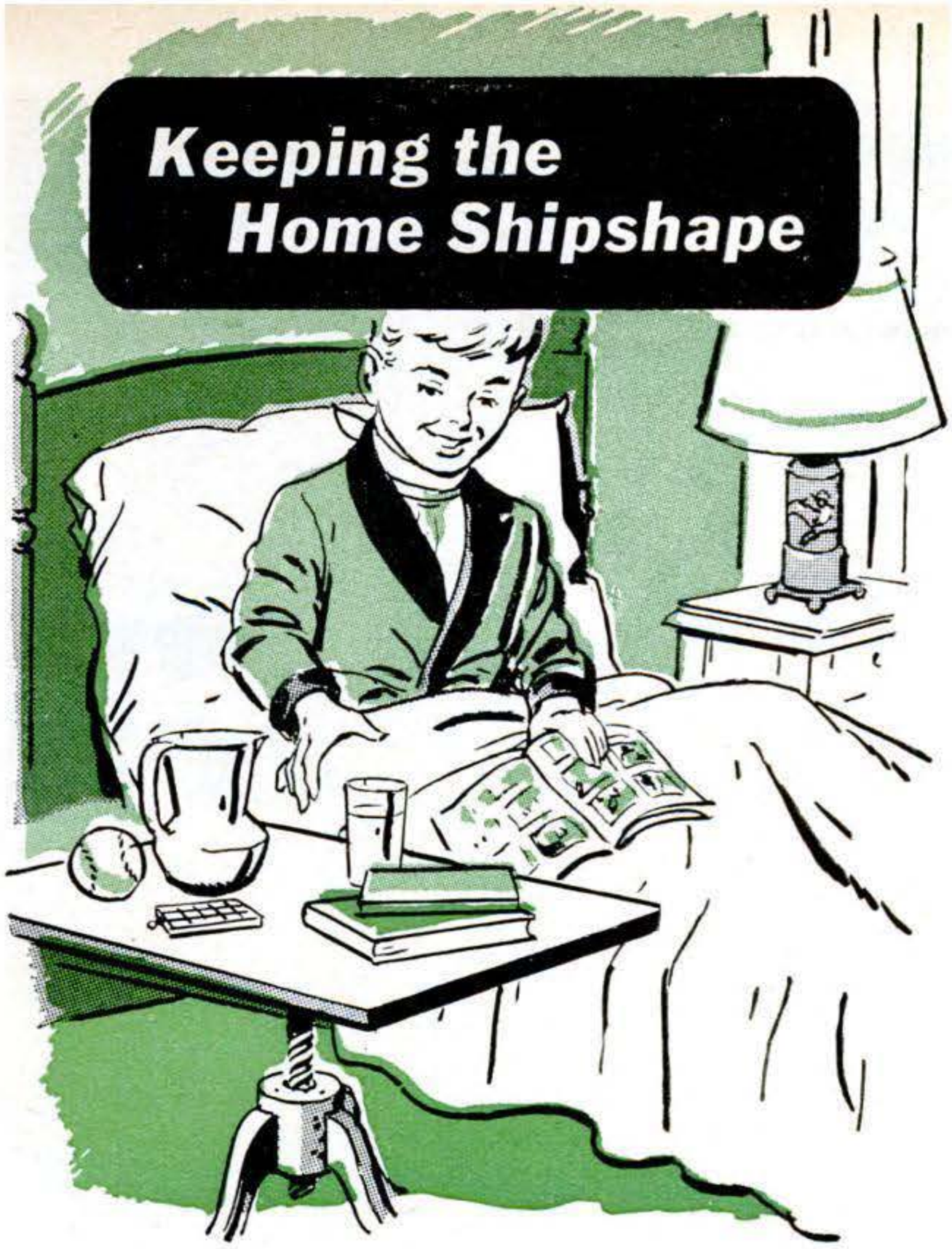
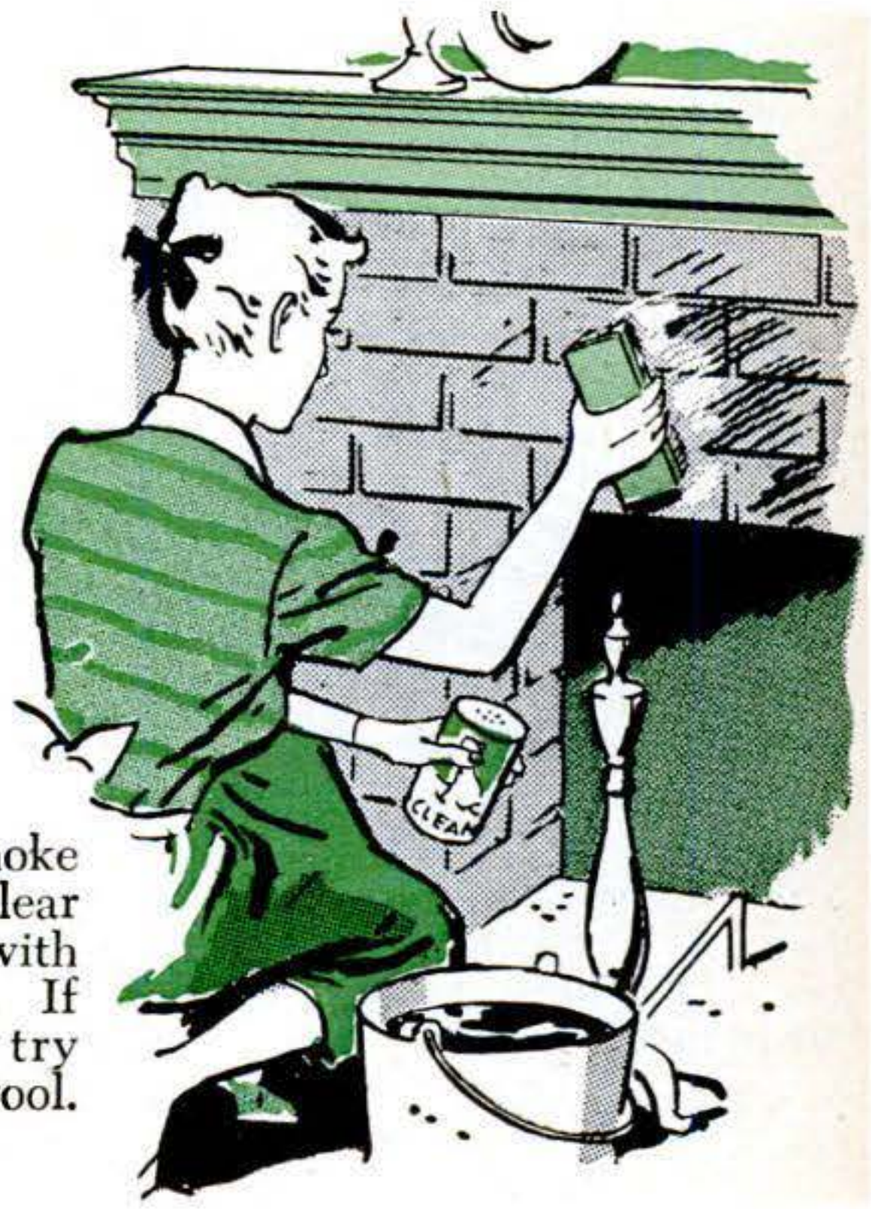
Keeping the Home Shipshape



A HANDY SICKROOM TABLE can be made from an old piano stool. Nail a piece of plywood to the top and you have a table that can be adjusted for height and swiveled around by the patient to bring everything within easy reach.

LOW-CUT MEN'S RUBBERS that have stretched can be made to fit tightly again by cementing a piece of weather stripping inside each toe. It works on women's half rubbers, too.



TO CLEAN BRICKS of smoke stains, wash first with clear water and then scrub with suds and a stiff brush. If stains are stubborn, try cleanser and steel wool.

A NEAT BORDER for flower beds is formed by driving leftover asbestos shingles part way into the ground. The shingles are rotproof and can be inserted in a variety of designs.

DRYING SWEATERS by hanging them with a towel passed through the sleeves keeps them from stretching out of shape and eliminates marks from clothespins. Hang T shirts this way, too.

Please turn the page for five more suggestions.

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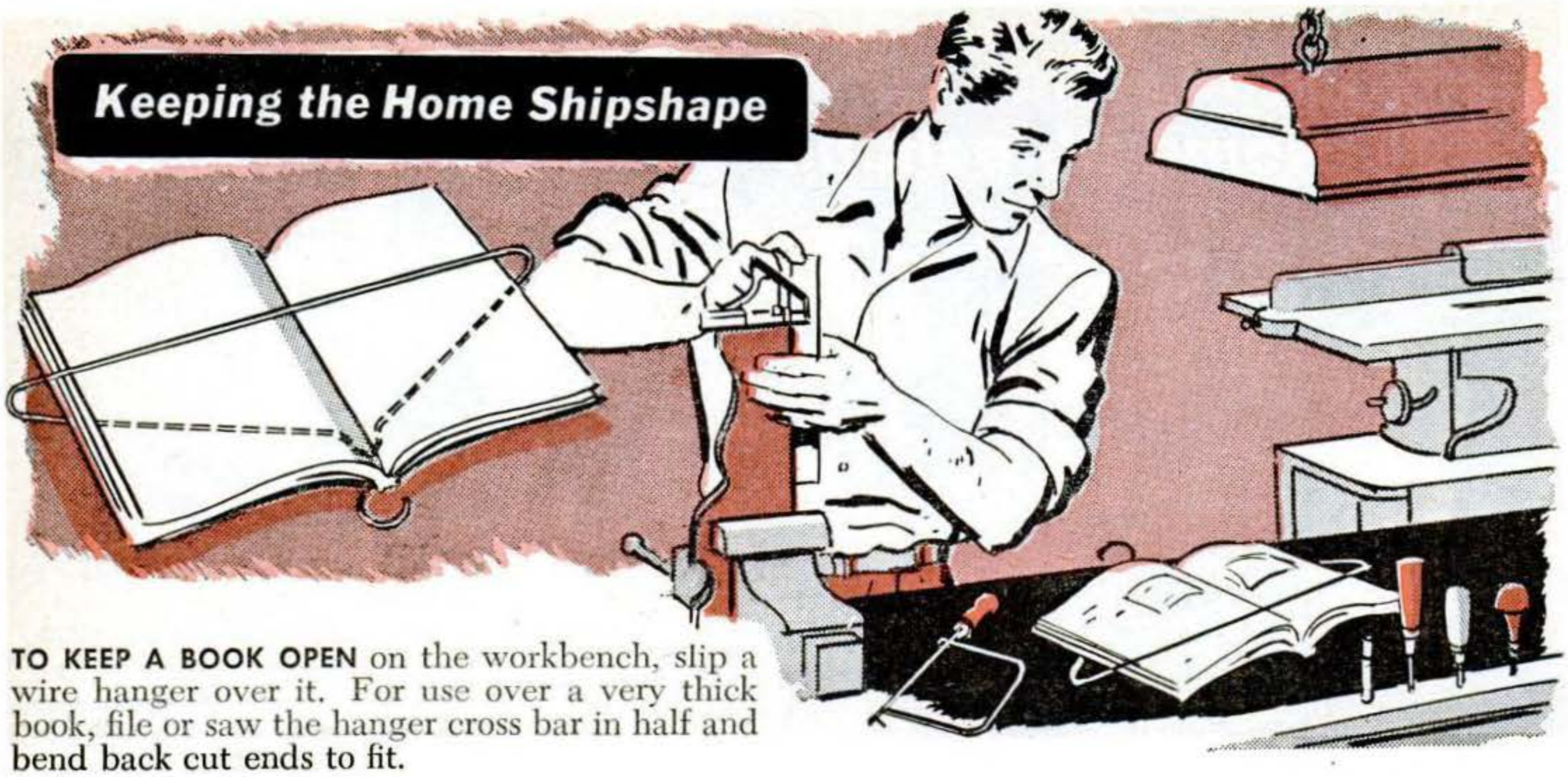
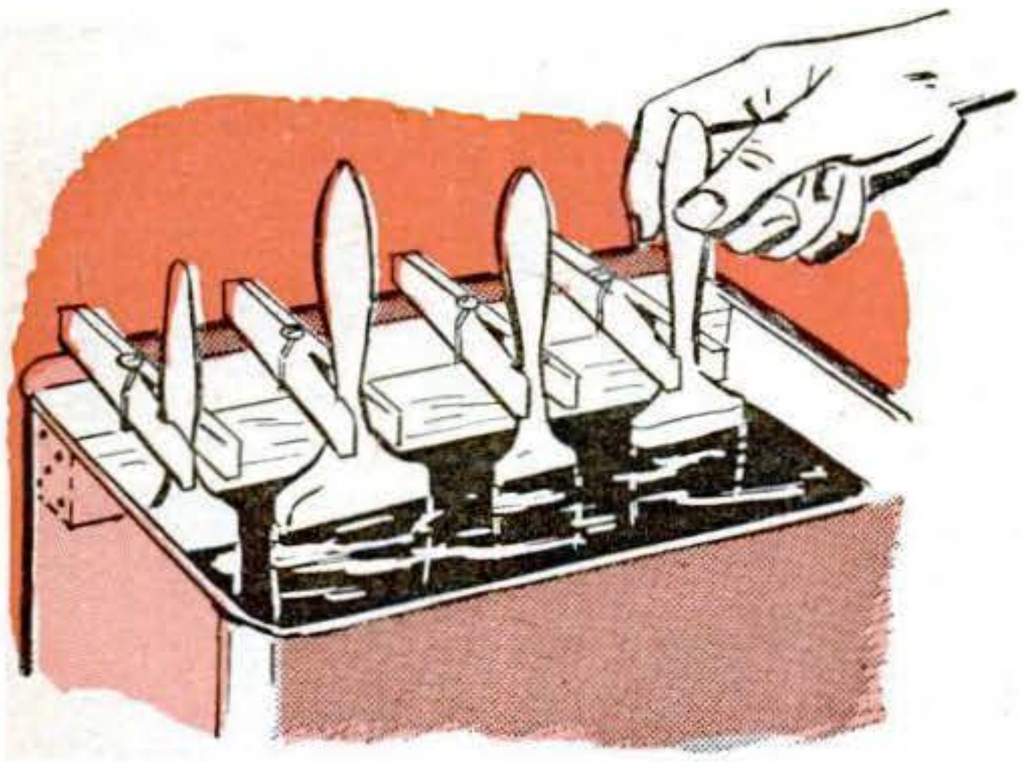
Keeping the Home Shipshape



TO KEEP A BOOK OPEN on the workbench, slip a wire hanger over it. For use over a very thick book, file or saw the hanger cross bar in half and bend back cut ends to fit.



PAINTBRUSHES hung in this solvent tank are gripped by spring clothespins. The tank is a gallon can with one side cut out. The pins are screwed to a wood strip fastened across the opening.

DUST CLOTHS pick up and retain dust better if moistened slightly with turpentine (below). Any turpentine film left on furniture will evaporate without damage to the wood.

GARDEN TOOLS will last longer if you clean them after use. Keep a copper scouring pad handy and rub each tool vigorously with the dry pad to rid it of dirt before putting it away.

RUG CUSHIONS will stay flat for vacuum cleaning if a square of hardware cloth is laid down and the vacuum is run over it. Just move the screening as you work.

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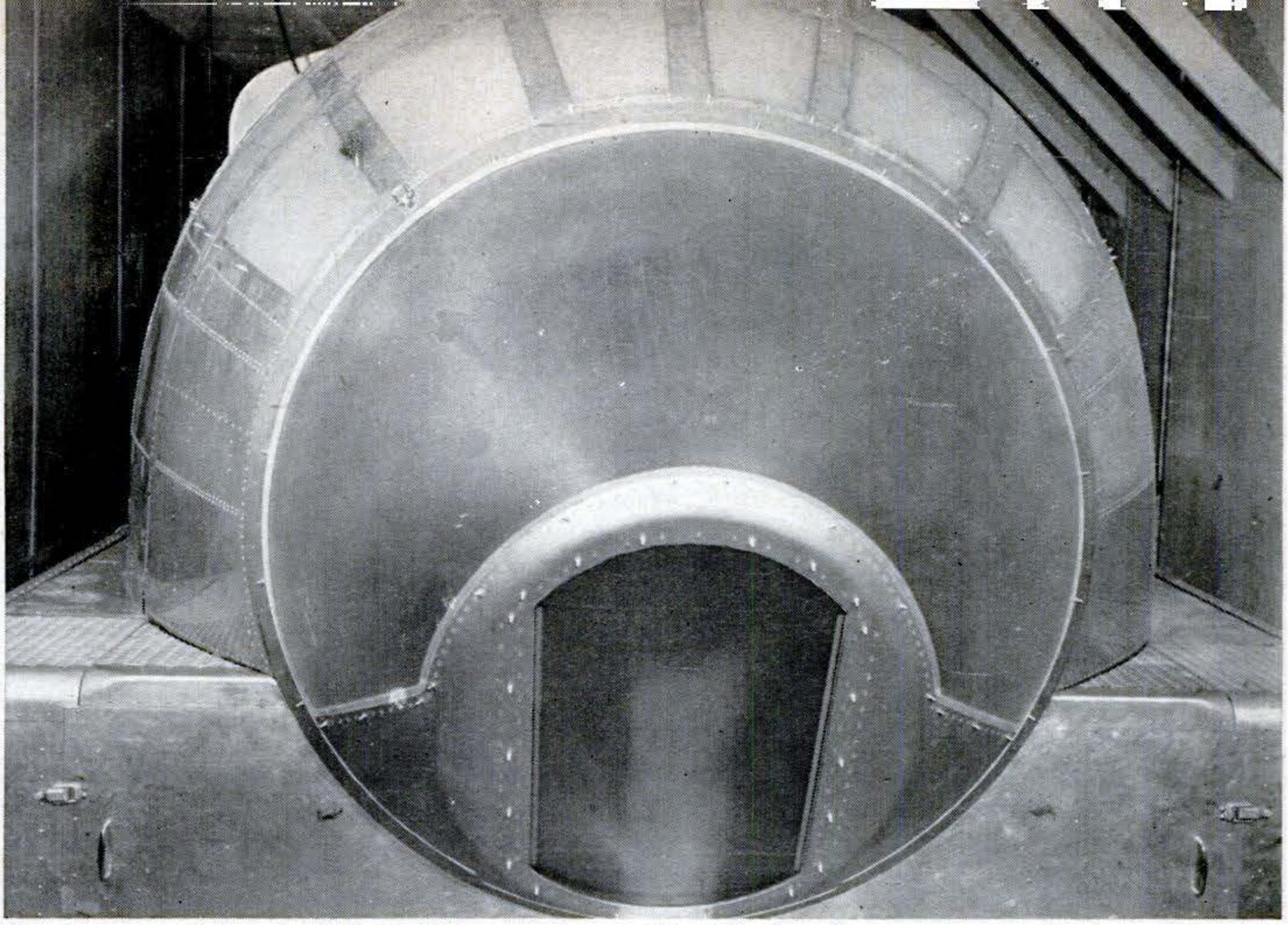


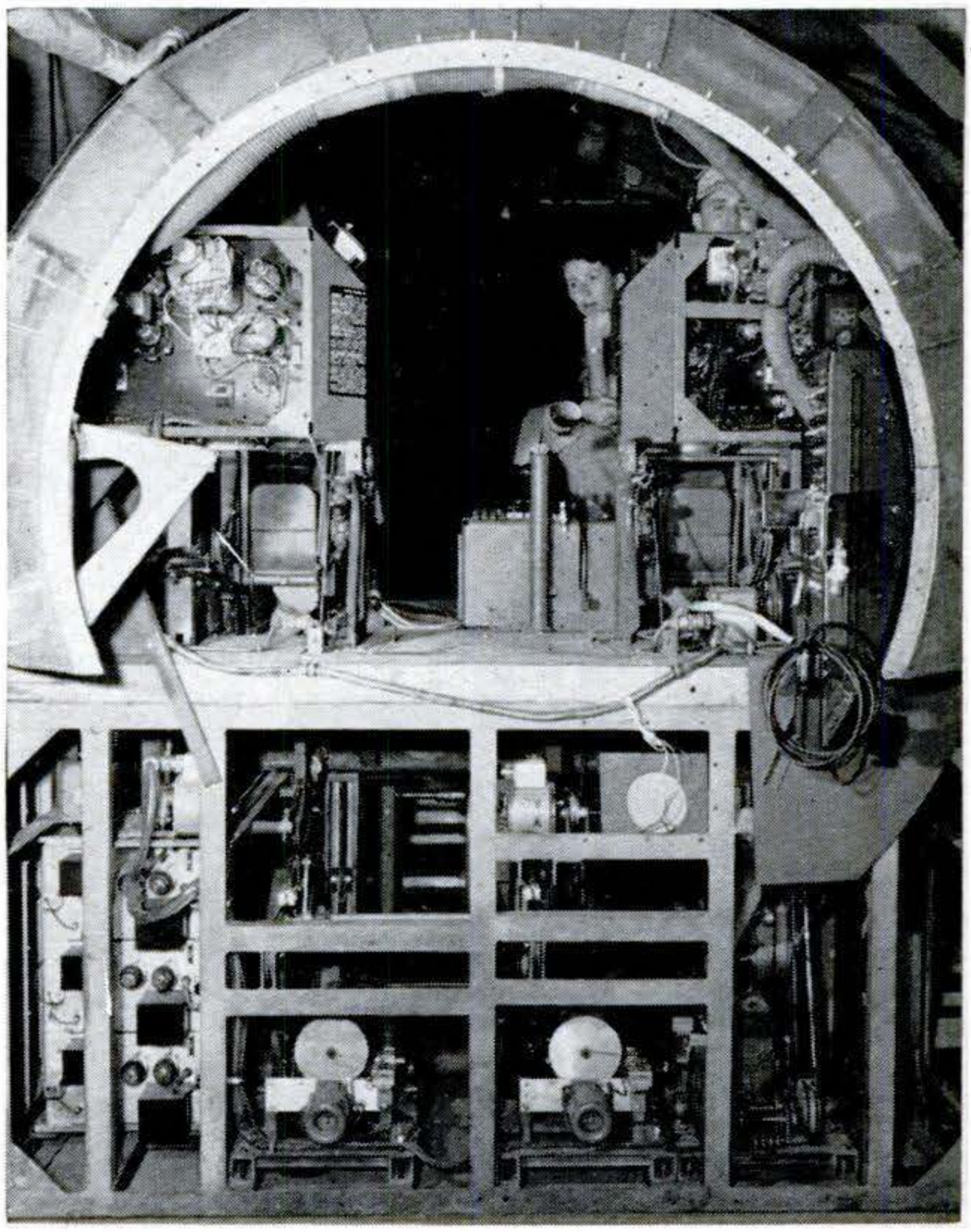
Head-on view (above) of B-50 flight simulator. Plexiglas bomber nose, normally clear, is frosted.

This "Bomber" Has Trouble on Every Flight

THE Gremlins of World War II have been replaced by a "hell-box" to torment B-50 Superfort flight crews at Walker Air Force Base, Roswell, N. M. It has more than 40 built-in tricks to bedevil the pilots—including engine failure, fire, stuck landing gear, even bad weather that calls for blind landings.

Fortunately, the flights never leave the ground. This B-50 is an electromechanical "simulator" which faithfully reproduces various flight conditions, as well as the cockpit itself, of the bomber. Thus it not only speeds training of crews in normal flight but familiarizes them with hazardous emergencies —all without danger to men or costly aircraft.

Use of the simulator is expected to save more than half the flight-training time needed in the actual bomber.



AMONG DEVICES FOR SIMULATING FLIGHT is loudspeaker, right above under floorboards, that produces sounds such as tire squeaks on "landing." Girl in background is psychologist who takes notes on pilot's reactions.

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THAT'S A REAL AIR SCOOP under the hood ornament—it feeds the carburetor. Only a tenth bigger than De Soto's six, V-8 is 38 percent more powerful, producing 160 hp.

De Soto's V-8: Most Powerful for Its Size

Nobody's sure how it does it, but it puts out 160 horses and can hit 100 m.p.h. going away.

IN ONE of Detroit's leading automobile plants there is a happily puzzled group of engineers. They've got a brand-new engine, and it produces more power than it ought to—by their own slide-rule computations.

The engine is De Soto's version of the Chrysler V-8 introduced last year (PSM, Mar. '51, p. 134). It produces more horsepower for its size than any other American standard-size passenger-car engine announced so far. Out of 276.1 cubic inches of piston displacement, it sucks 160 horsepower at 4,400 r.p.m.

Like the Chrysler engine, it has hemispherical combustion chambers. Like the Chrysler, it has overhead valves and push rods branching off in weird directions. But it's smaller than the Chrysler, which displaces 331 cubic inches, it contains subtle refinements, and its compression ratio is only 7.1 to 1. The 180-horsepower Chrysler's is 7.5 to 1.

Good Pickup at 75 M.P.H.

A PSM reporter drove a car with the new engine—just now going into 1952 De Sotos—on Detroit's high-speed Expressway. The car, a four-door sedan, had a torque-converter transmission supplemented with the company's semiautomatic Tip-Toe Shift. It carried three people and a tank of gas.

This is the way the performance clocked out on a speedometer described by Bernard

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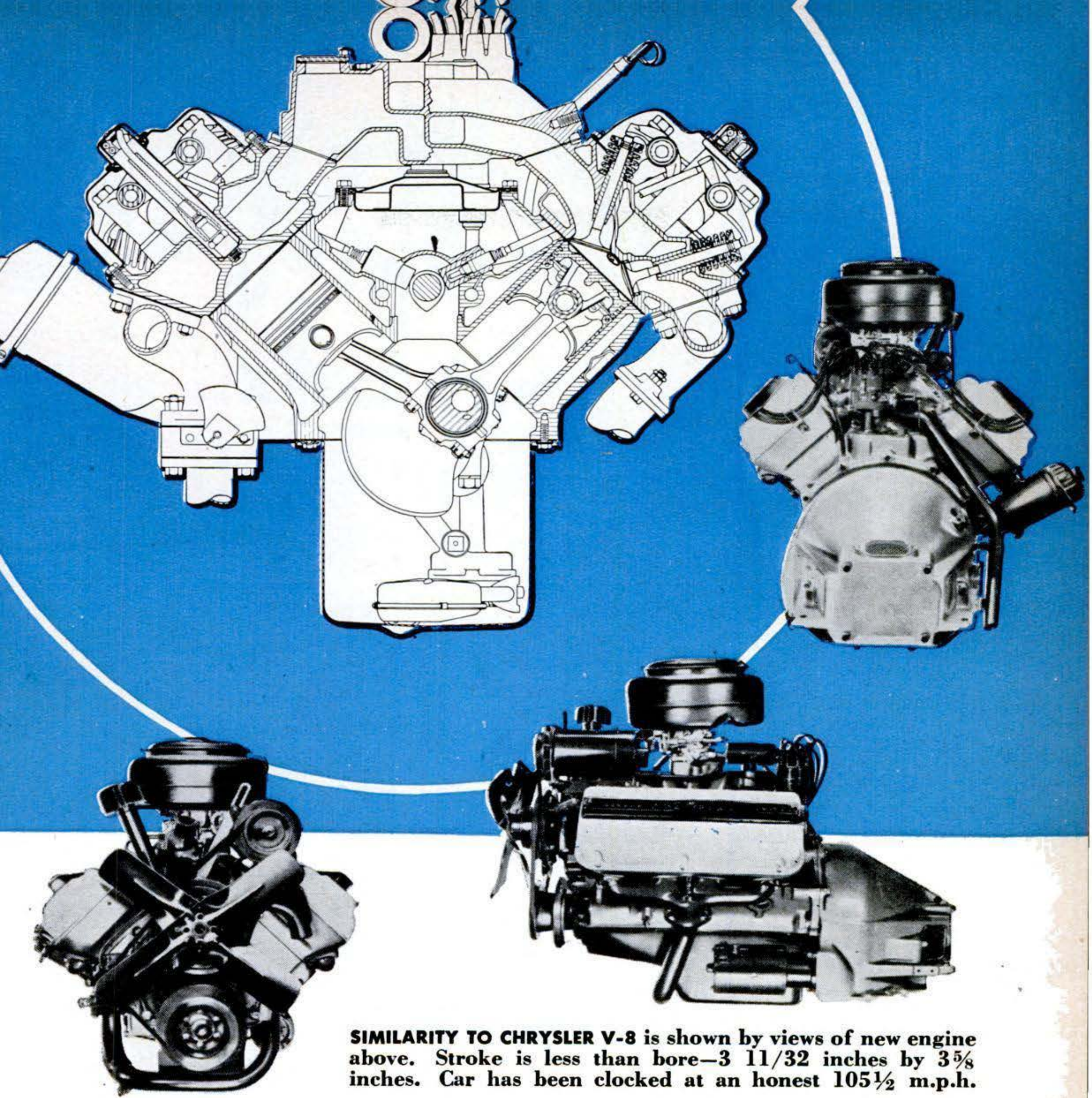

SIMILARITY TO CHRYSLER V-8 is shown by views of new engine above. Stroke is less than bore—3 11/32 inches by 3⅝ inches. Car has been clocked at an honest 105½ m.p.h.

Meldrum, chief engineer, as "pretty close to accurate":

It took only 5.5 seconds to reach 30 miles an hour, eight seconds to 40, and 13.7 seconds to 60. We were indicating 80 miles an hour in 25.6 seconds.

Drifting back to 75 miles an hour, we tromped on the accelerator. Even at that speed, where the average engine's power begins flattening off, the pickup felt like a boot in the pants.

For comparison, we tried a six-cylinder, 116-horsepower De Soto. The results:

It took 8.4 seconds to reach 30 miles an hour, 10.6 seconds to 40, 23.4 to 60, and 42 to 80. The acceleration at 75 wasn't much.

The six was the same engine that has satisfied a host of De Soto owners. It was just outclassed.

The main secret of the V-8's power is, like the Chrysler's, the hemispherical head. The engineers aren't quite sure what goes on in there when the pistons suck in the air-gas charge and the spark ignites it. All the rules in the book say a given piston displacement and a given engine design should produce a given amount of power, and no more. The V-8 breaks the regulations.

The relatively low compression ratio only adds to the impressiveness of its performance. Most cars since the war have had their ratios steadily boosted to get better combustion and more power, sometimes up to nearly 8 to 1.—*Devon Francis.*

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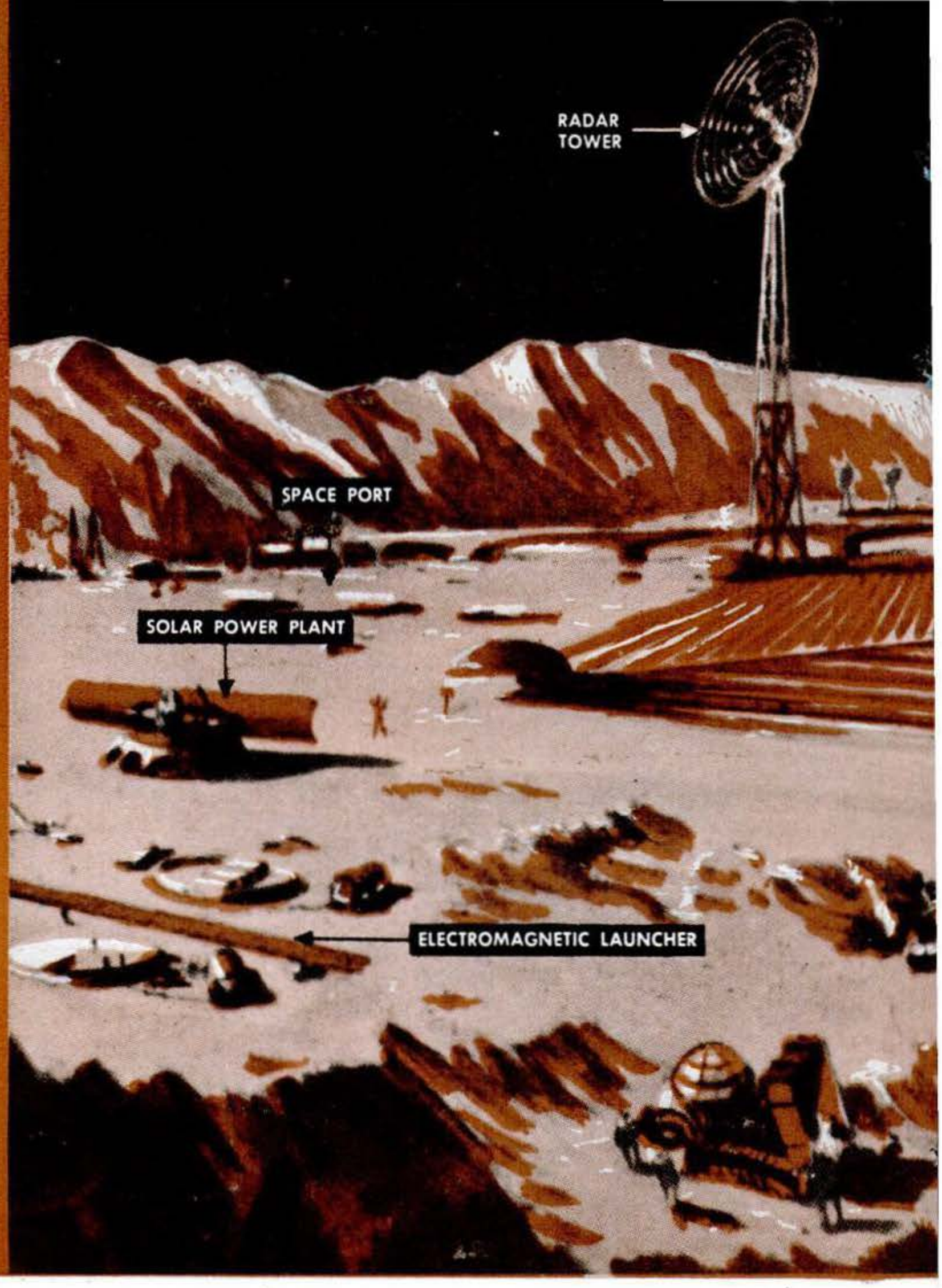
LUNAR BASE

THE experts no longer argue *whether* men will someday ride rockets into outer space. They've moved on to planning *how*.

But *where?* First of all, obviously, to the Moon, which is only a hundreth as far away as the nearest planet: some 240,000 miles—an easy five-day trip—compared with 26,000,000 miles to Venus.

"The human race is remarkably fortunate," writes Arthur C. Clarke, chairman of the British Interplanetary Society, "in having so near at hand a full-sized world with which to experiment: before we aim at the planets, we will have had a chance of perfecting our techniques on our own satellite."

In the article that follows, Mr. Clarke discusses what we'll do when we get there. It is condensed from his new book, *The Exploration of Space*, to be published this month by Harper & Brothers.



What Will We Do

Chairman of British Interplanetary Society tells how explorers

By Arthur C. Clarke

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TODAY we can no more predict what use mankind may make of the Moon than could Columbus have imagined the future of the continent he had discovered. Nevertheless, it is possible to foresee certain lines of development which appear likely as soon as we have reached the Moon, and we can also discuss, in general terms, the problem of making it habitable.

The things we are to discuss now will not happen quickly, and some will remain unaccomplished for centuries. But in the end they will be achieved—unless better, perhaps more fantastic solutions are found.

The first lunar explorers will probably be mainly interested in the mineral resources of their new world, and upon these its future will very largely depend. If we are to set up permanent colonies, it is essential to discover oxygen, water and materials from which food may be obtained.

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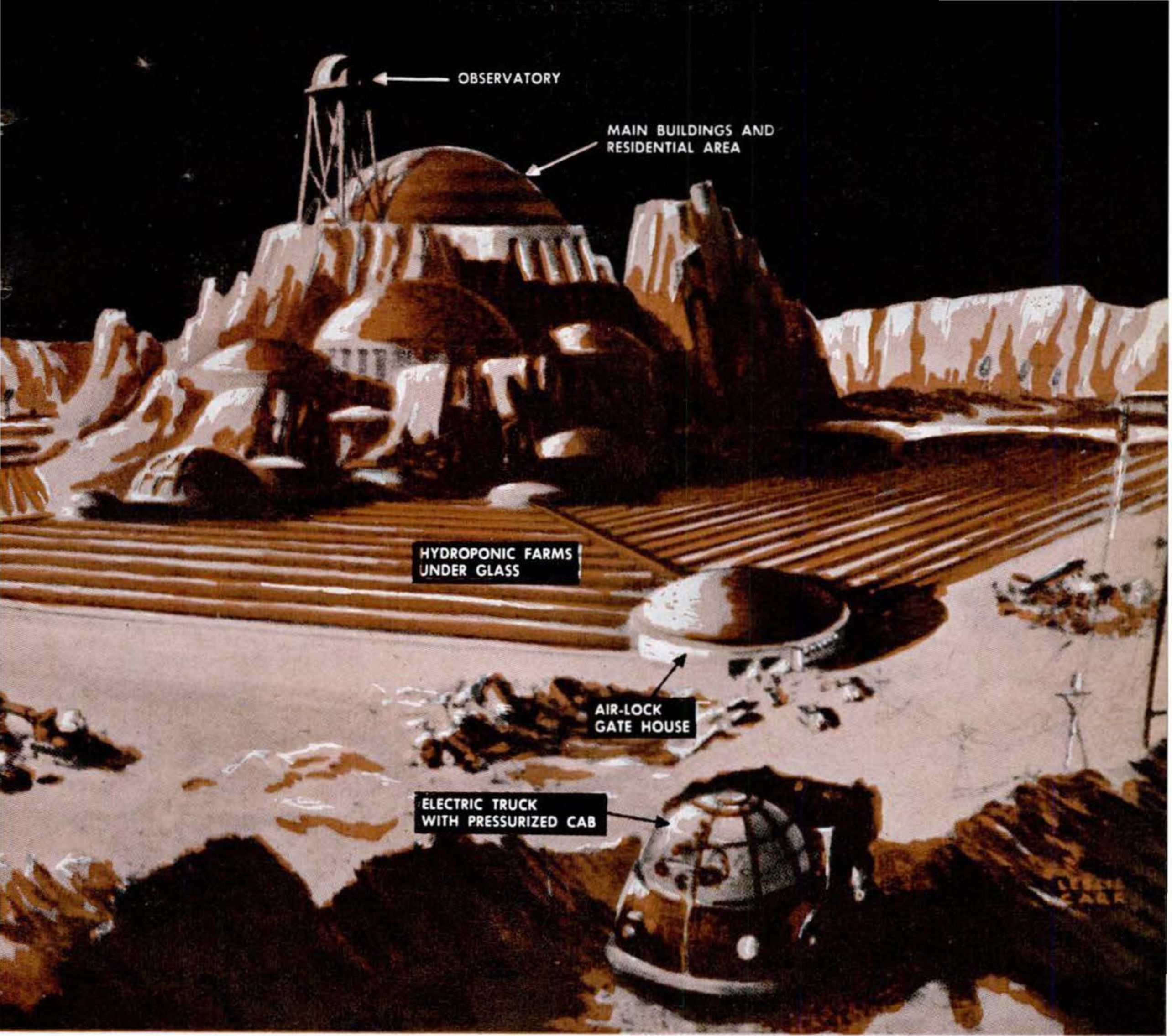

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with the Moon?

in refrigerated suits will expand igloos into a pressurized city.

With the spaceships themselves acting as bases, the area around each landing point will be carefully prospected by men wearing space suits. In the space suit, because there is no pressure outside, there will be a very considerable force tending to make the suit rigid, like an inflated tire, thus spread-eagling the unfortunate occupant. This has already been encountered in the design of suits for high-altitude flight.

For this reason, space suits may have to be fairly inflexible structures, with articulated joints at elbows, knees, etc., to allow for the necessary movements. They would thus resemble suits of armor, and might be just about as comfortable. Luckily the low gravity would simplify the problem of weight, though it must be remembered that the *inertia* would be unaltered. (On the Moon it would be six times easier to lift a sledge hammer than on the Earth—but it would be just as hard to swing it.)

If even this sort of construction does not enable reasonably form-fitting space suits

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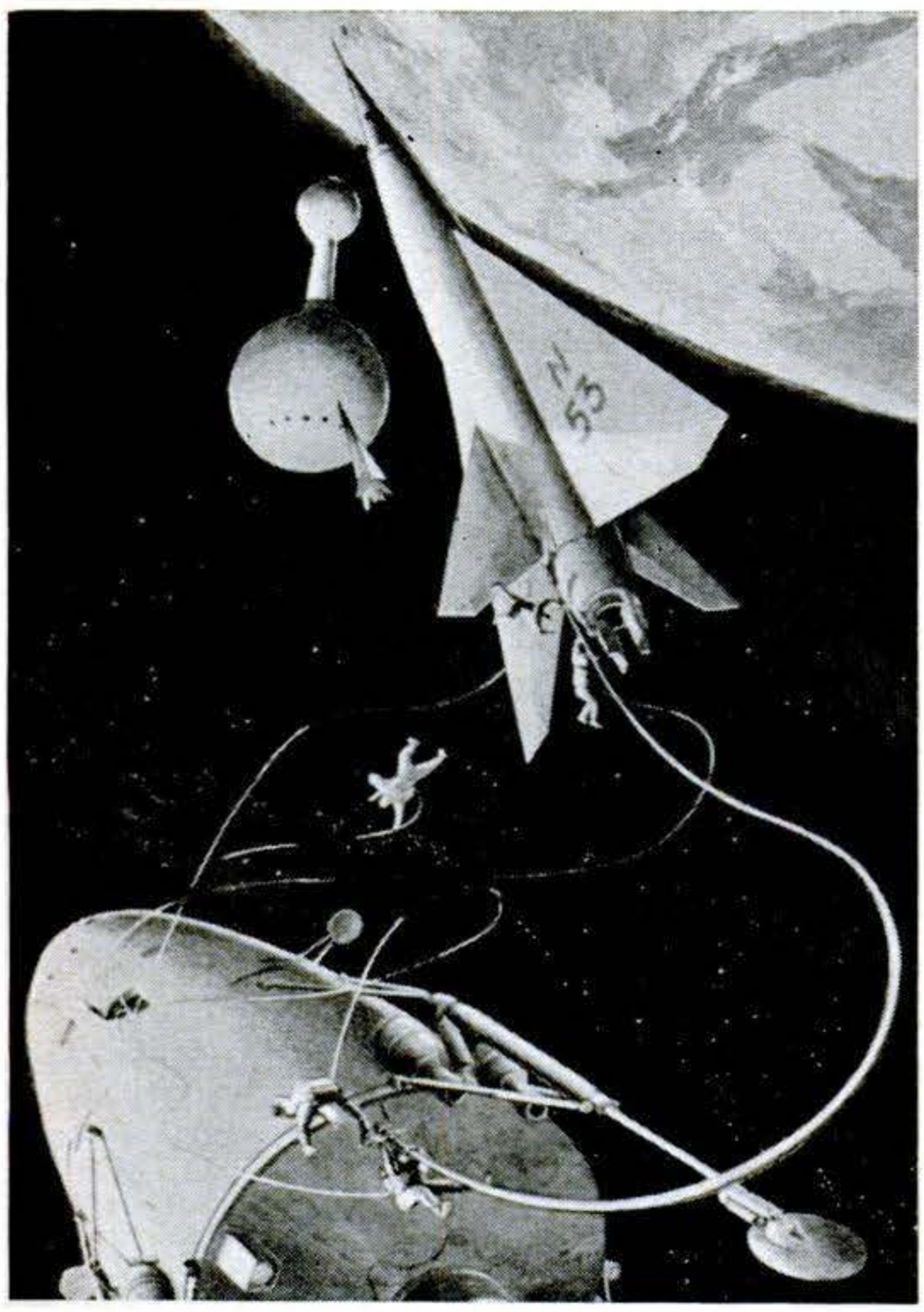
to be practical, a more drastic solution may have to be found by making the suit completely inflexible—perhaps a simple cylinder with windows—and providing it with exterior metal limbs, the legs possibly motor-driven. Indeed, it must not be assumed that legs would be the best answer to the problem of locomotion. On a planet of low gravity a spring-operated pogo-stick arrangement might be much more useful.

The provision of air for such suits presents no great difficulty: oxygen for periods of 12 hours could be carried in cylinders of reasonable size. A more serious problem is temperature control, particularly on a body like the Moon, where if one moved a few yards from sunlight to shadow the temperature could fall 400° in a matter of seconds. It would be possible to insulate the suit from its surroundings—it could be a very efficient form of vacuum flask—but this is highly undesirable, as the wearer would soon get heatstroke owing to the thermal energy his body was developing. To counter this, it seems that space suits would have to be provided with a small refrigerating unit for use during the day.



SPACE TRAFFIC: A needle-nosed tanker ship refuels a rocket on its way to the Moon. Both were launched from the Earth in the noses of larger rockets that have dropped away. In the distance another streamlined tanker approaches a dumbbell-like orbital spaceship, or space station, that continuously circles the Earth or Moon without landing anywhere. It has fuel tanks and pressurized crew chamber in the larger sphere, motors in the smaller one.

As there is no atmosphere—or certainly not enough to carry sounds—the explorers would have to keep in touch with each other, and with the ship, by radio. Range would be rather short and the service somewhat erratic owing to the Moon's rugged nature and near horizon—only two miles away from a man six feet high.

"Igloo" Will Be First Lunar Base

One of the first tasks of the expedition would probably be to erect as tall an aerial as possible. A 50-foot mast would give a radio range of about six miles, though this might be greatly extended if the Moon has an ionosphere.

Since a spaceship would hardly provide very commodious living quarters, an attempt would be made after the first few flights to build some kind of pressurized building or hut. This would probably be made of reinforced fabric or plastic material, blown up to form a hemispherical chamber and fitted with a small air lock. The whole thing would look very much like an Eskimo igloo, and would probably be silvered for heat insulation. Its inflation would mark the foundation of the Lunar Base.

For a considerable time all flights to the Moon would be directed to the same spot, so that material and stores could be accumulated where they would be most effective. There would be no scattering of resources over the Moon's 12 million square miles of surface—an area almost the same as that of Africa. Where the first landing will be must of course be decided from the preliminary photographic surveys made by robot or piloted rockets. Certainly it will be on the visible side of the Moon, so that the expedition can keep in touch with Earth.

Moon Observatory Planned

Within a few years of the first landing, it should be possible to establish a small camp on a permanent basis, keeping it supplied by a regular service of ships from Earth. A great effort would be made to set up an observatory with a telescope of moderate size: in fact it would be worth while building a spaceship for no other purpose than to carry a reflecting telescope of, say, 20 inches aperture to the Moon. The absence of an

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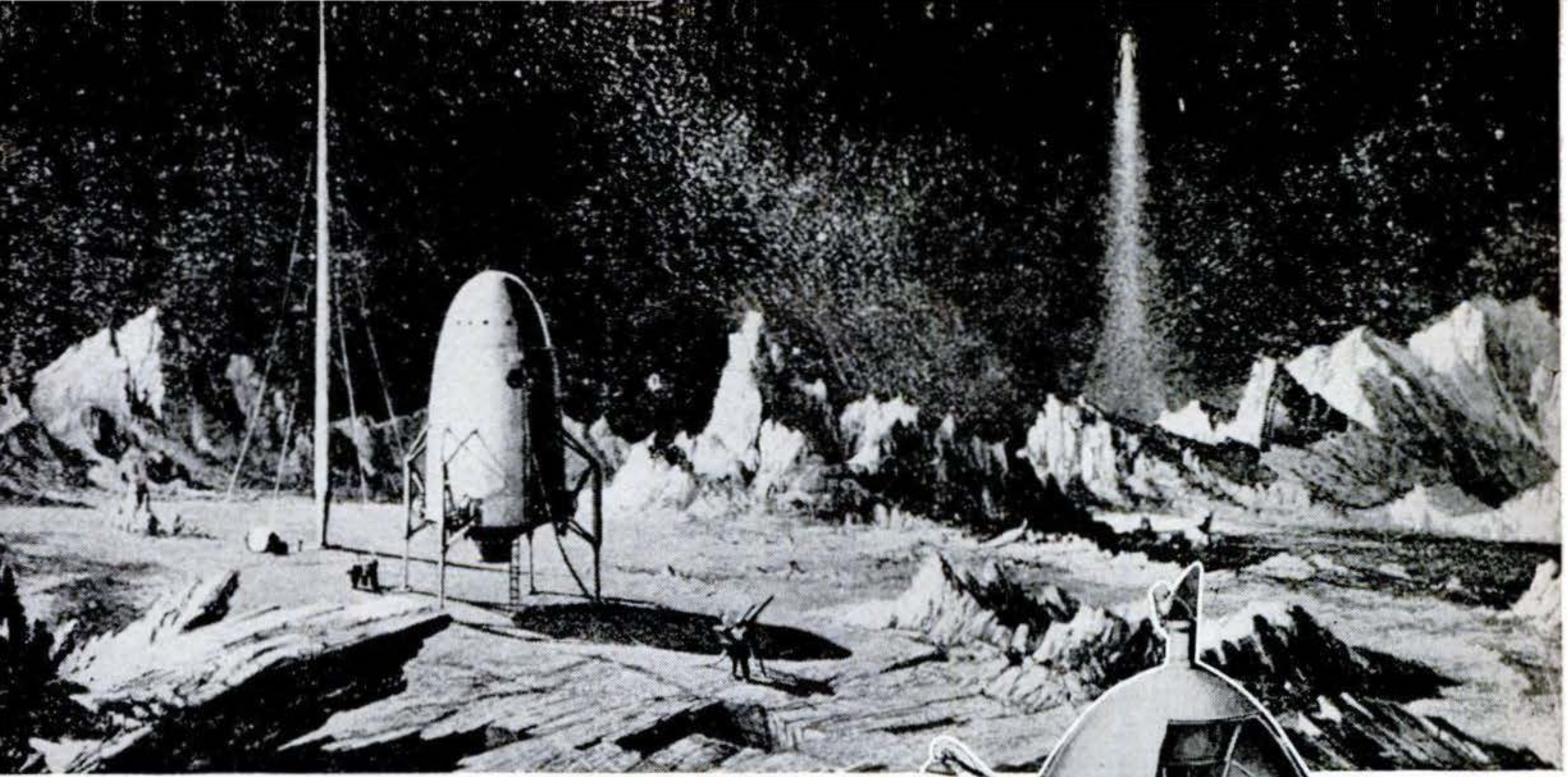
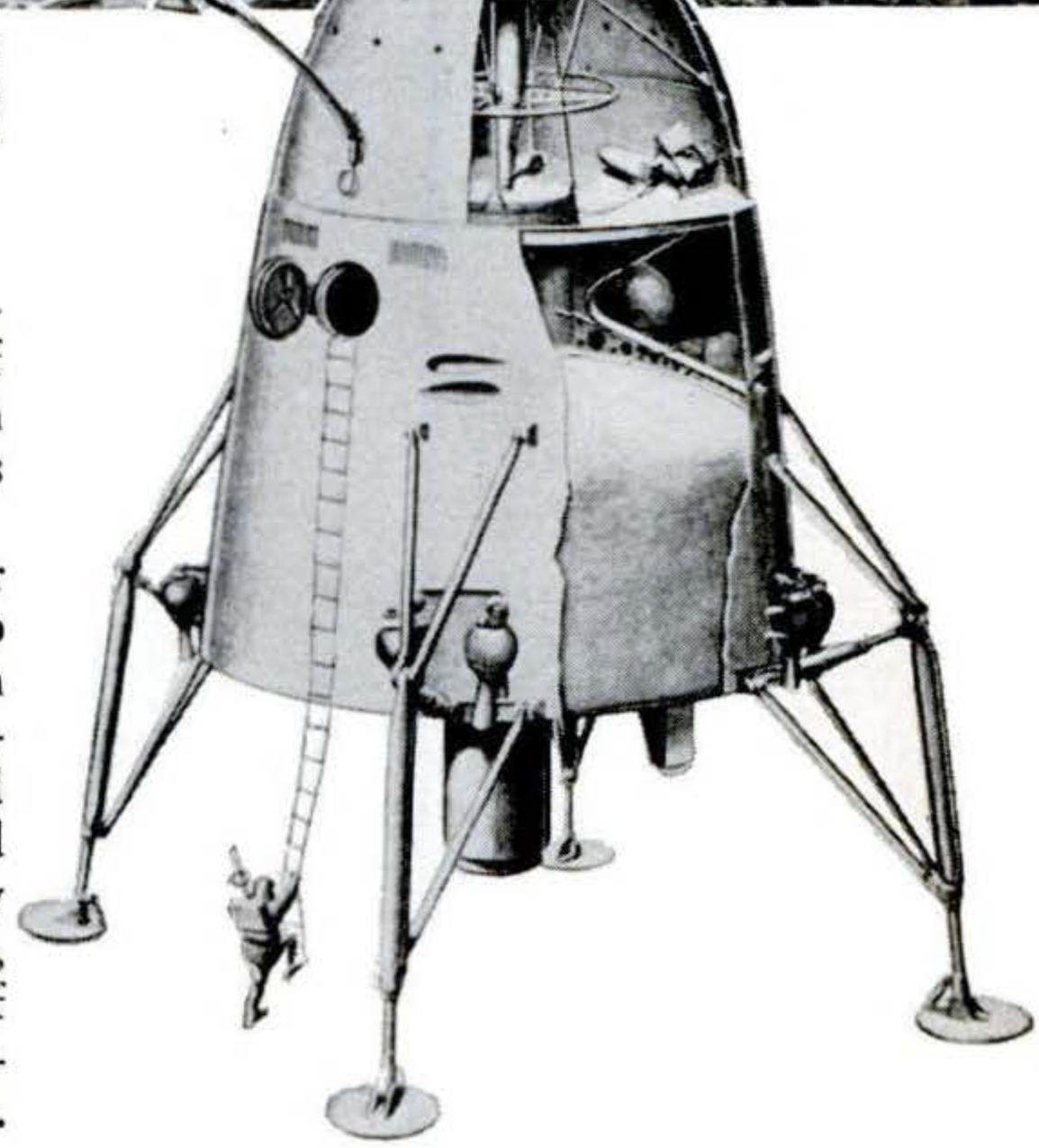


LUNAR SPACESHIP prepares to take off from the Moon. Four legs serve as both launching rack and landing gear. The ship lands backwards, its fall slowed by rocket braking.



atmosphere would mean that it would always be possible to use it to the limit of magnification—and not on the few dozen occasions a year, at the very most, which is the best that can be expected on Earth.

Since the lunar night lasts for 14 of our terrestrial days, it would be possible to carry out many types of observations which cannot be performed on our rapidly spinning planet. Beneath the Moon's black and utterly cloudless skies, astronomers would at last be able to see the stars as they really are. Under its perfect seeing conditions, such vexing problems as the existence of the Martian canals will be solved long before an expedition can reach that planet.

Expect to Find Oxygen and Water

When the time came to build really large telescopes, it would be a vastly simpler engineering proposition to do this on the Moon than on the Earth, since the low gravity would mean that a much lighter structure could be used. However, this is looking rather a long way ahead—to the time when there is a Lunar Colony and not merely a Lunar Base.

Although we cannot expect to discover appreciable oxygen in the free state, it should be remembered that this element comprises more than *half*, by weight, of the crust of our planet, and whatever materials the Moon may consist of will probably contain it in abundance. Given sufficient power it can, in principle, be extracted.

Water is also a common constituent of many minerals, and can be removed simply by heating. On the Moon it would be possible to obtain plenty of heat, during the daytime, by focusing sunlight with a simple arrangement of concave mirrors. However, the sheer physical problem of handling the quantities of rock involved would be considerable.

Early Base May Be Underground

It would simplify matters greatly if water could be found in the free (frozen) state. It is quite possible that it may occur in caves, or on the surface in temporary deposits. Given electrical energy, it could then be electrolyzed to provide oxygen, and the

[Continued on page 264]

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Piper Cubs Become Siamese Twins

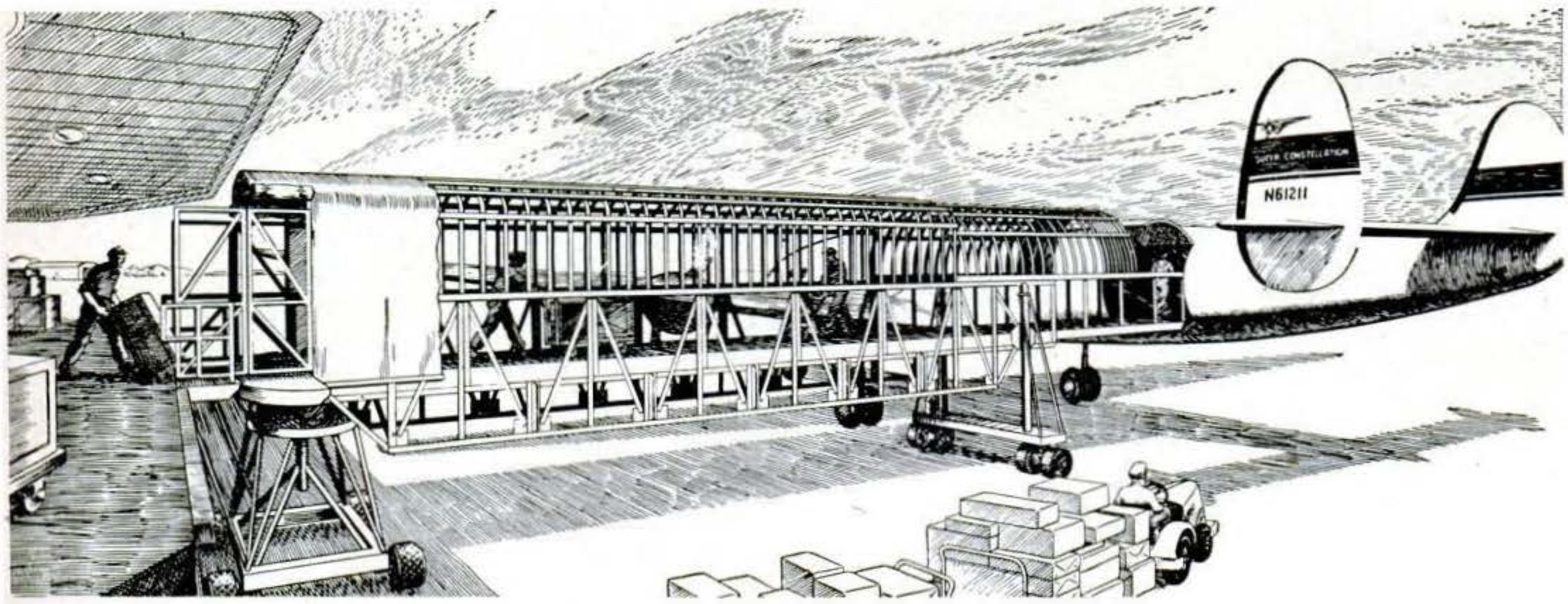
To get twin-engine performance at the cost of only two small airplanes, Harold Wagner of Portland, Ore., nestled two Piper Cubs beneath one wing, as shown at the right.

Wagner staggered one unit two inches behind the other to keep the propellers from clashing. The units are so close that the tip of the rear prop clears the shaft of the front one by three inches.

Transparent Boat Looks Like Bubble—That's What It's Made From

At a distance of 50 yards, the occupants of this transparent-plastic boat appear to be sitting in the water. It was built by James R. Hageman of Glendale, Calif., from two surplus aircraft-nose bubbles and cost less than $20.

The two sections were cemented together. Blocks of plastic, cemented in place, hold the oarlocks, motor mount, pulleys and keel. The craft, powered by the smallest commercial outboard motor, can reach a speed of eight knots.



Mobile Gangplank to Load Plane

The familiar ship's gangplank is to be put to work loading airplanes. Called the Aerobridge, it will be used as a runway for moving passengers or freight from loading dock to plane. A removable canopy will protect passengers in bad weather.

Powered by electricity, it will move from place to place and pivot at its dock end through a 180-degree arc. The main span, supported by two dollies, will include a cantilever section at the outer end that can extend it from 76 to 89 feet. Lockheed Aircraft designed the gangway.

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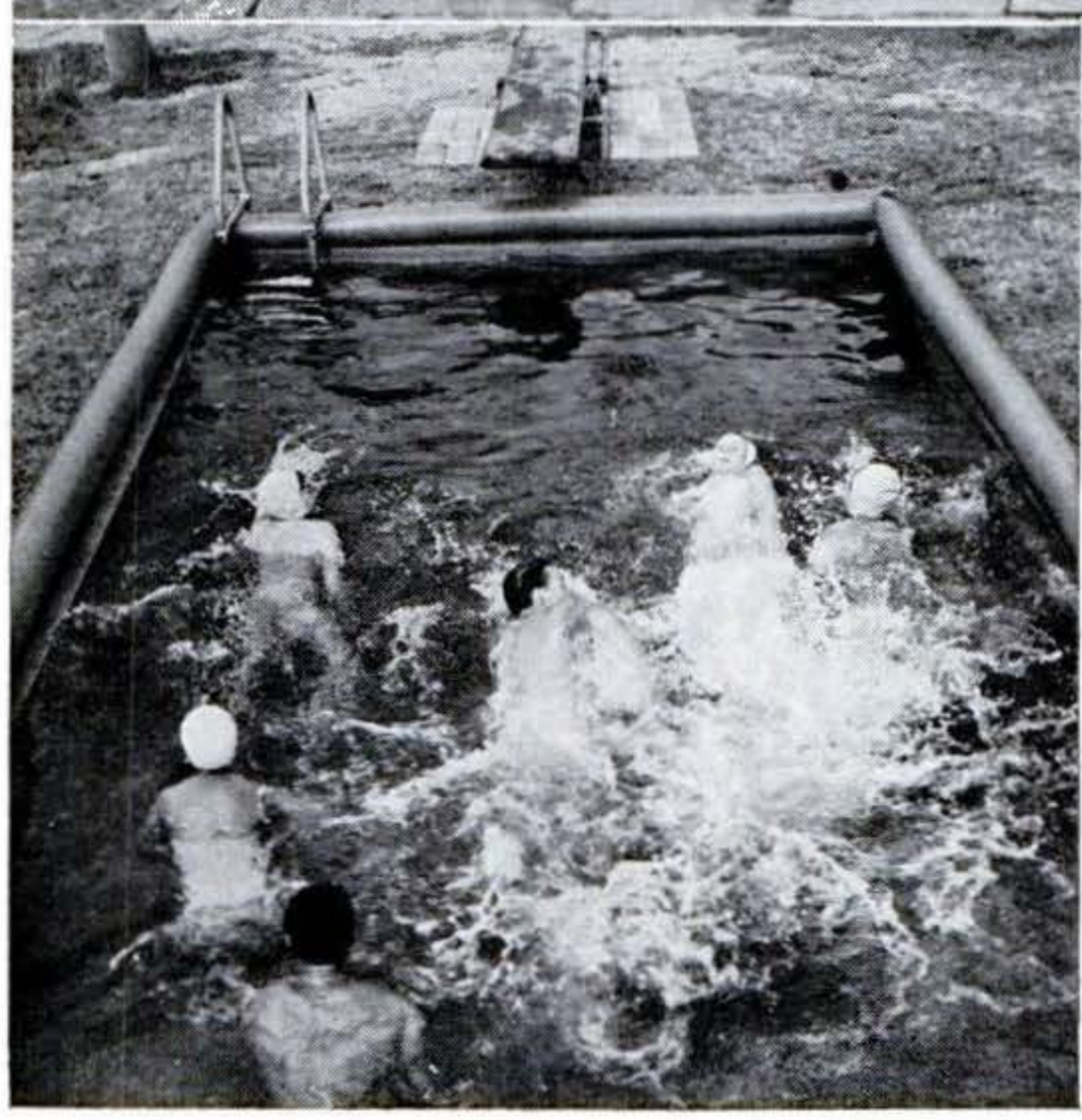

Back-Yard Pool Is Plastic

WANT a full-size back-yard swimming pool that won't cost you a fortune? You can have a pool like this one for $275. It is made of Bakelite sheeting, holds more than 10,000 gallons of water and has room for 15 water enthusiasts with no crowding. The depth is graduated from three to five feet.

It is anchored in the excavation with two-by-fours at each corner and empties through a drain hooked up with an outlet pipe or with a sump pump. The Bilnor Corp., Maspeth, N. Y., makes it.

Atomic Ashes Stored in Moat

THE man with the pole is stirring up the ashes from an atomic furnace. They are spent slugs of uranium from the nuclear reactor at Oak Ridge, Tenn. Used slugs are pushed out of the back of the pile as fresh ones are loaded from the opposite side. The "clinkers" fall into this moat to cool off under nine feet of water—a good shield against radiation—until they can be safely removed for permanent storage. The slugs, an inch thick and four inches long, weigh about 2½ pounds—more than lead—and the furnace holds more than 30,000 of them. That's about 40 tons of uranium.

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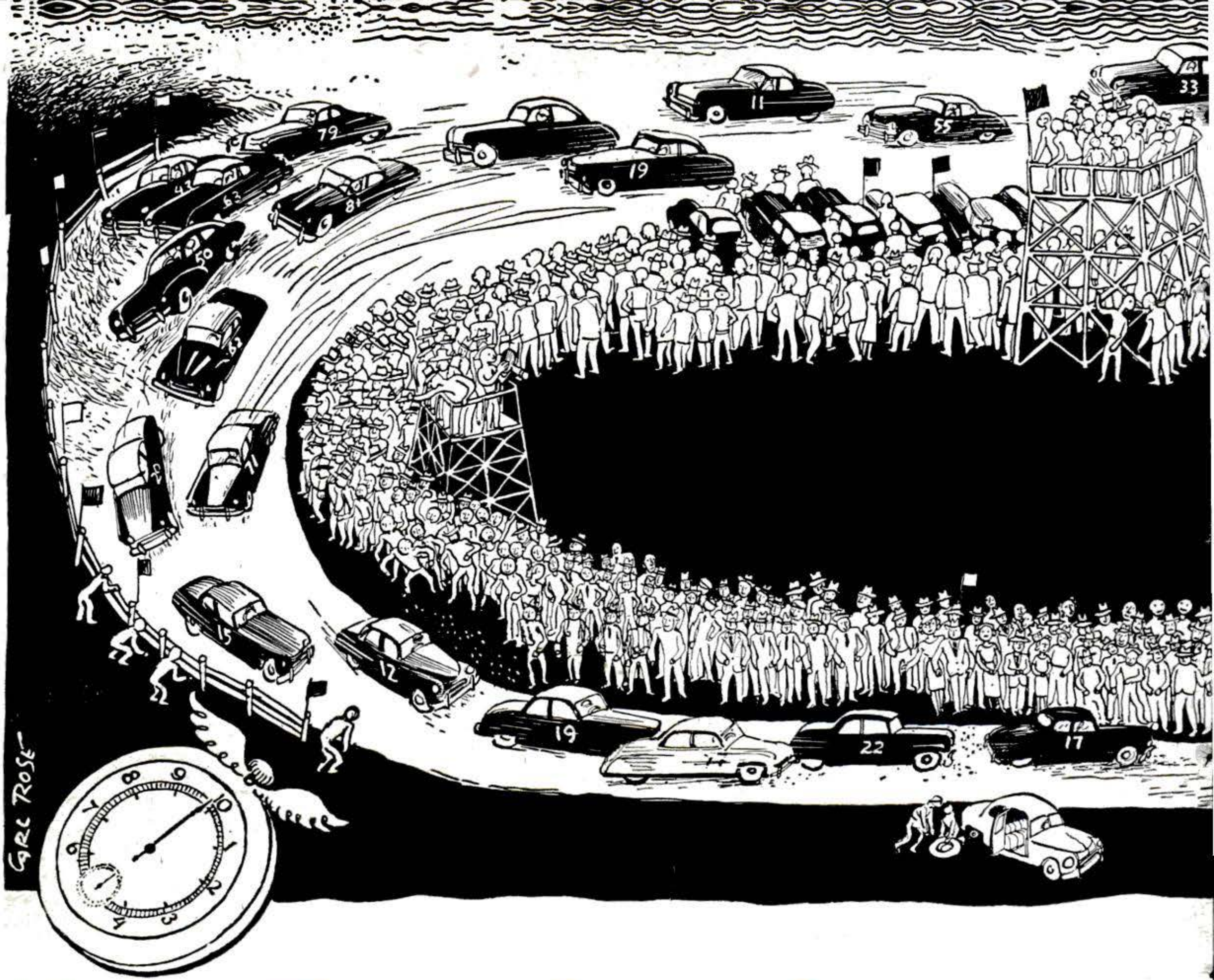

How Fast Are the New Cars?

By Charles W. Morton

DAYTONA BEACH, Florida, is a twin-tailpipe town. More than any other American community, it is absorbed in automobiles. It likes the looks of a glossy new car. It responds to the sound of that new car (properly souped, ported, relieved, manifolded and tuned). And especially, it enjoys the sound and sight of that new car, blatting its way through an electrically timed mile trap on what the town—with all correctness and modesty—calls "the world's most famous beach."

During Race Week, each year in February, Daytona not only sizes up the new cars but pits them against its own unique proving ground—Daytona Beach. From every part of the United States, the motorist comes to Daytona, to see or to be seen, according to what he is driving. He may come to watch, or he may be doing his own stuff against the clock, and several hundred of him will be serious race drivers, complete with trailers, crash hats and bright-colored blouses.

The fantastic contests that attract him occur on Daytona's 4.1-mile road-racing circuit—two miles of beach course parallel to two miles of concrete highway. These two sections are linked at each end by banked hairpin turns which the cars enter and leave on the beach side, through soft, deeply rutted, bumpy sand.

For testing purposes, it would be hard to

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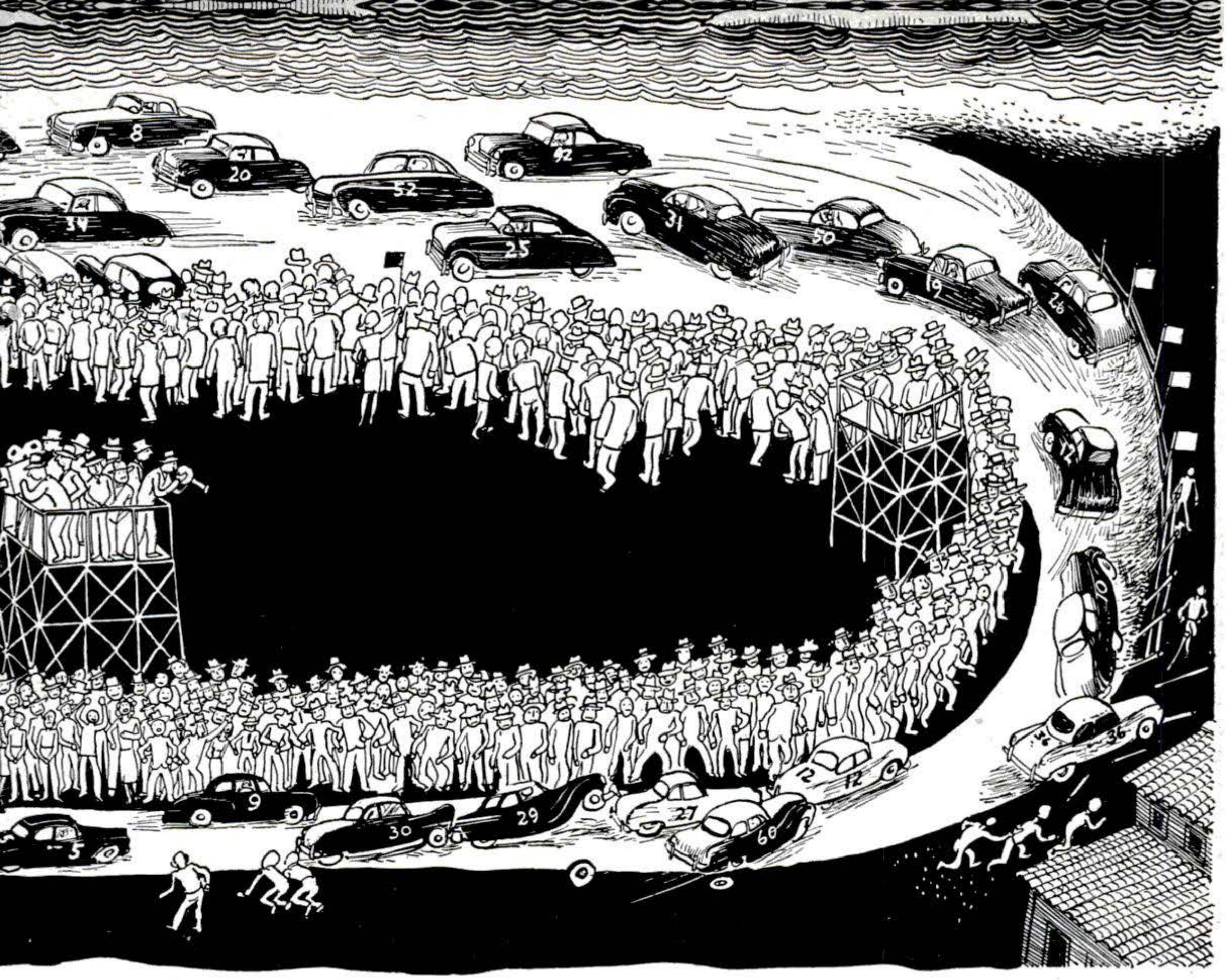

This year's Daytona tests of the "stock" models have shown that you don't have to buy a foreign car to make real time on the road.

lay out a course which could equal Daytona's in showing up performance characteristics. There's a two-mile straight for full acceleration and maximum speed, and rough, heavy going in the turns, an ordeal for any car's roadability, toughness—and driver.

In setting up "strictly stock" racing—not to be confused with the hot-rod and jalopy hippodroming which has sprung up on tracks everywhere—the National Association for Stock Car Auto Racing (Nascar) has made a brisk start in a direction which has been largely neglected.

"Strictly stock" needs a column of fine print for definition as to what may or may not be permitted, but the general intent is to describe a car using parts offered for sale by its own manufacturer and available to the general public. Thus, although a stock car performing at Daytona or Detroit or Darlington, S. C., is undoubtedly taking advantage of everything that its manufacturer offers, and is tuned to a hairline in addition, its main characteristics can be reasonably judged by the ordinary motorist. He can see, too, how it compares with other makes under the same conditions.

Three Nascar Tracks Are Different

Nascar's Detroit circuit is a one-mile dirt track that is a rugged test of durability. An entirely different performance problem is posed by Darlington's fast mile-and-a-quarter banked asphalt track, where the distance and the speed make tires and tire changes a powerful factor.

At Daytona, engine output, in the extreme slowdowns and high-speed opportunities af-

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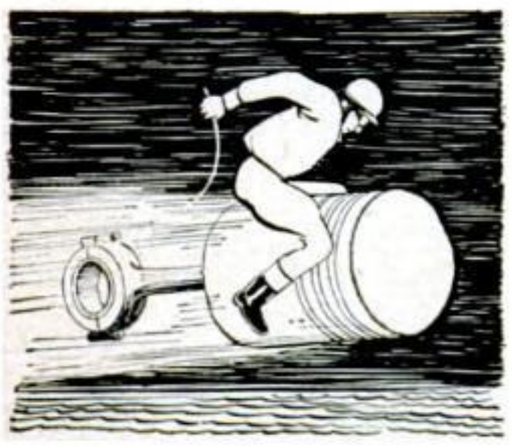
ROUGH GOING. Sliding into the soft sand, two-time winner Marshall Teague takes the turn into the hard-packed beach section of the Daytona speed course. The other half of the route is a concrete roadway. Teague took first place in this year's "strictly stock car race" with an average speed of 84.65 miles an hour; last year he won with an average of 82.39 miles an hour.

forded by the turns and straights, becomes all-important; most drivers agree that a fast-enough car could win any Daytona race simply by hitting it up on the stretches and loafing through the turns.

Out of these varieties of proving grounds comes a fair basis for judging how the new models stack up against each other, and by the end of the racing season Nascar meets will have given the manufacturers as well as the motoring public a broad view of what is there—and what is lacking. In general, on the basis of Daytona's February Race Week, the 1952 models seem to be slightly faster than the '51 crop.



Hudson Hornets ran first and second in the 1952 Daytona race for "strictly late-model (1950-52) stock cars." Marshall Teague, the winner, averaged 84.65 miles per hour over the 152-mile distance (37 laps), and the runner-up Hudson finished one minute and 21 seconds behind him. A '51 Chrysler was third, while Olds was the only other make represented in the first 12 cars to finish. Teague had won last year's race in a '51 Hornet at 82.39 m.p.h.

To describe Daytona's road races as fantastic is no exaggeration. There were, for example, 63 "late models" entered in the strictly stock event this year, and some of the high-speed traffic situations in the turns had to be seen to be believed. On the day before the stock race, a 100-mile event for hot rods—won by Tim Flock at an average of 87.55 m.p.h.—had a starting field of 118. Only 48 survived the distance.

At low tide, Daytona Beach is anywhere from 1,000 feet to a third of a mile wide, and this affords the field all the room possibly needed for the full-speed run, northbound up the beach, and a wide choice of angles on which to slant into the soft-sand approach to the north turn.

Shooting into the rutted sand at around 75 or 80, a car loses enough speed in the thick going to hit the fairly well banked—but very bumpy—hairpin at about 50, and that is roughly the speed at which a driver begins his southbound rush down the concrete road. This is no boulevard. Being barely wide enough for two cars, with edges on both sides bounded by soft sand, it is a surface which few motorists would care to exceed 60 on.

South Turn Is Vicious

The approach to the south turn is little or nothing to slow a car down: one instant it is barreling along the concrete, and the next it's hitting the banking. The heavy slogging in the soft sand comes when it bounces down from the banking to the upper part of the beach. Here—if a car is still right side up—it seems to shake off the forces that have been slowing it down, and it winds up all over again on the sprint north.

Teague made his winning drive look very easy. Equipped with a hand shift and dual carburetion, his Hornet sailed around the circuit in front all the way. Through the

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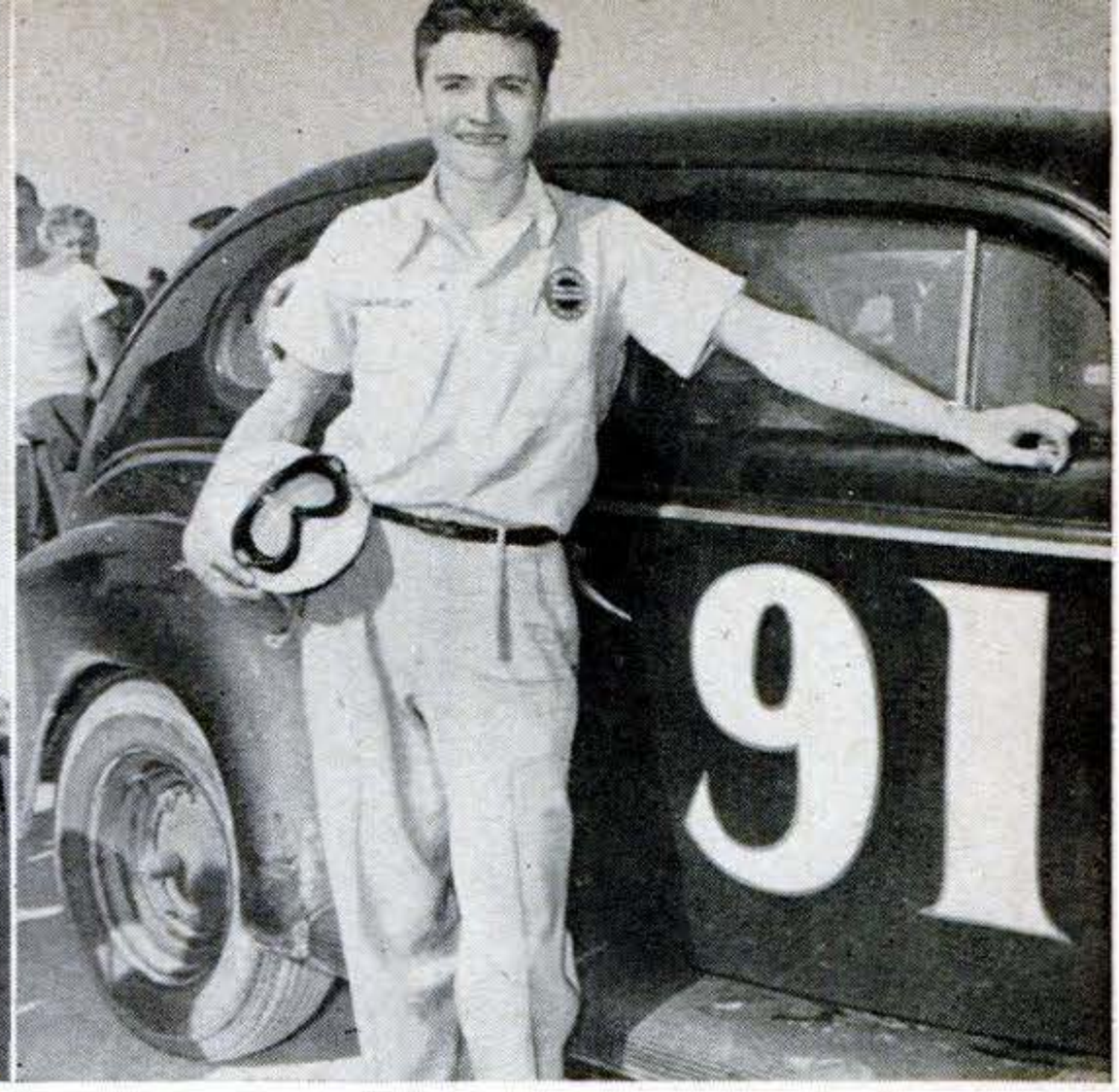
ALL IN THE FAMILY. Marshall Teague (right) gets the winner's congratulations from second-place driver Herb Thomas of Olivia, N. C. Both drove '52 Hudsons owned by Teague.

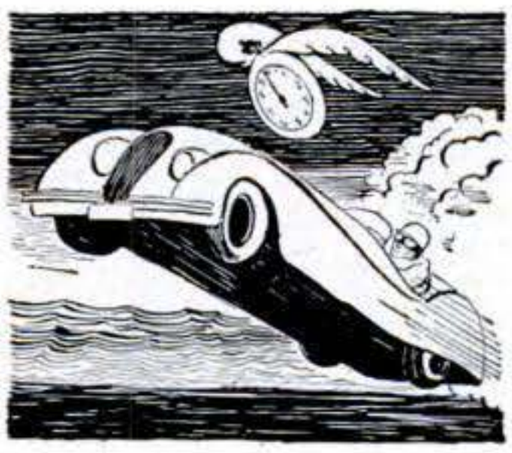


YOUTHFUL WINNER of "sportsmen-type modified stock car race" was Tim Flock of Atlanta. Flock's 1939 Ford covered the 100-mile run at an average speed of 87.55 miles an hour.

heavy stuff his course was unswerving, although the wild leaps and swings of many other cars must have seemed like faster running to everyone except the timers. The driver of a 1950 Olds put on all manner of acrobatic slides at the turns, yet finished tenth.

Speed Tests Exciting, Too

Daytona's speed tests, like its road races, are sponsored by Nascar and for most of the nonparticipants are just as interesting as the races. In the course of a February forenoon, for instance, a 14-year-old boy went through the timed mile on a 125-cc. Harley Davidson, a tiny, light machine which sounded like an oversized electric razor, at 58.21 m.p.h.; and a hard-top '52 XK 120 Jaguar coupe—one of the few thus far on the road in this country—breezed the southbound mile at better than 110 and the north-bound at 107 for an average of 108.18 miles an hour.



The owner of this Jaguar, who had driven it down from Connecticut with his wife, reported a speedometer reading—usually highly accurate on this car—of 120 m.p.h. on his southbound mile. This would indicate the degree of slippage which sets in at high speed even on the hard sands of Daytona in contrast to the better traction afforded by concrete.

The late Sir Malcolm Campbell's Bluebird set a world's land-mile record of 276.82 at Daytona in 1935, but the same car shortly afterwards, on the harder surface of the Bonneville Flats in Utah, proved 24.31 m.p.h. faster and became the first to cross the 300 mark. All in all, at speeds of around 100 or more, the beach is probably five to 10 miles an hour slower, but what it loses in traction it very nearly makes up in the magnificent straightaway run from which the driver enters the timed zone.

During this year's time trials the cars took a four-mile stretch to get up speed, sufficient for most. Yet the driver of a '52 Cadillac whose southbound run was clocked at 106.22 said he hit the timed mile with a speedometer reading of 104, which reached 110 and was still going up at the end of the measured mile. He was refused a northbound run on the grounds that his power-steering unit was disconnected. This Cadillac ran silently and was certainly a very fast car indeed, whereas the solitary '52 Cadillac in the strictly stock road race was never in the running at any stage.

Henry J vs. M.G.

A '52 Henry J ran the southbound mile, favored by the wind, at 73.47, only a shade slower than an M.G., which turned the same distance at 76.46. A Mark VII Jaguar sedan averaged out at 100.94 for both directions, while another M.G., a '52 Mark II, boosted the pace for that manufacturer to 79.49, including a southbound run at better than 84.

An elderly and rather portly man wheeled

[Continued on page 288]

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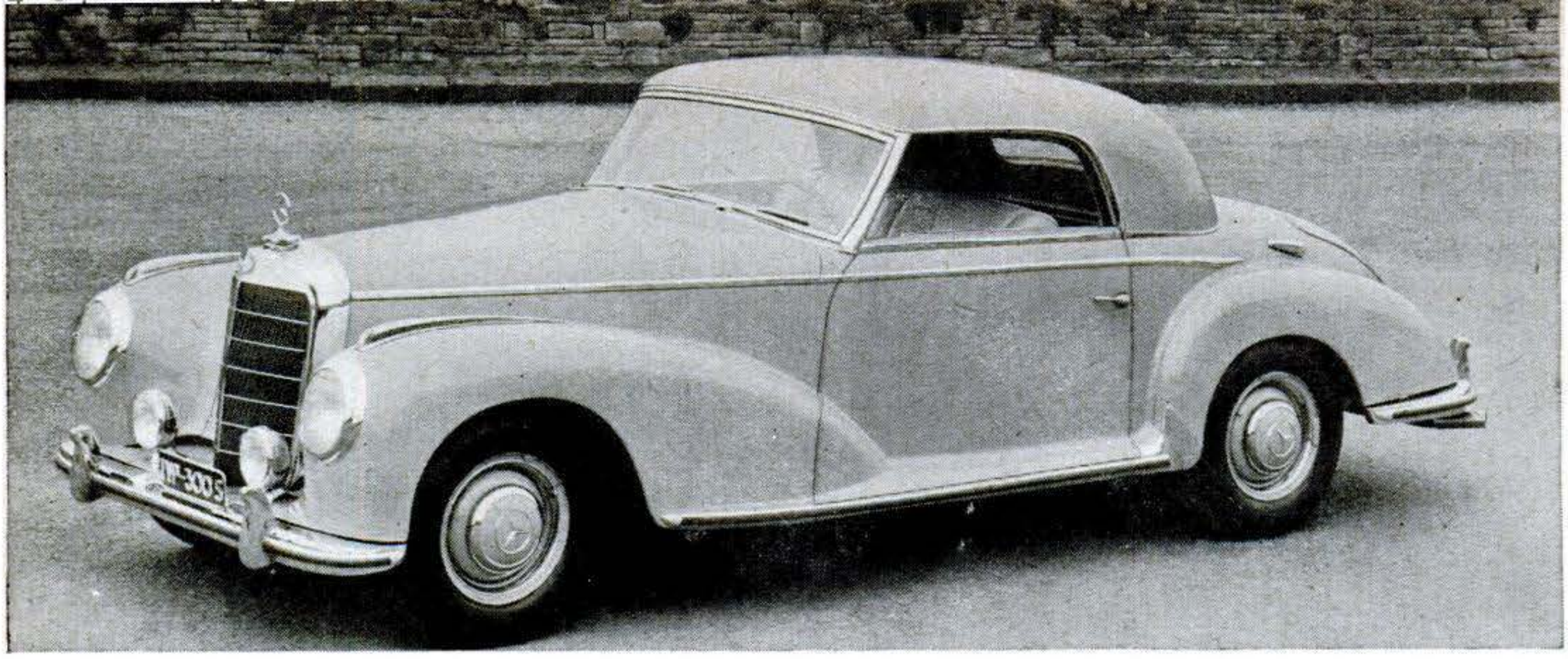
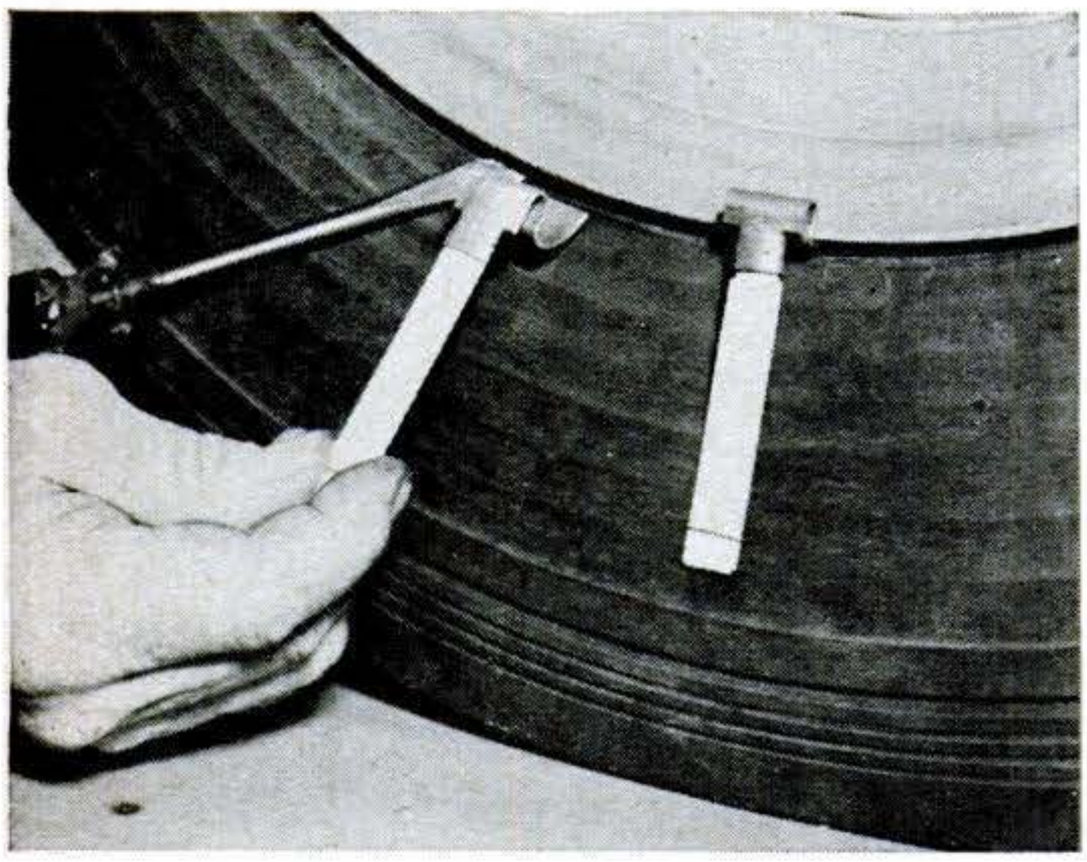


New Mercedes Tops 100 M.P.H.

A NEW model of the famous German-built Mercedes, now in production, has been clocked at 108.7 miles an hour. The 300 S, available in hard-top or convertible versions, has a six-cylinder, overhead-camshaft engine of 182.8-cubic-inch displacement, with three downdraft carburetors. It turns out 150 horsepower at 3,260 r.p.m. About 24 miles per gallon is claimed for medium speeds.

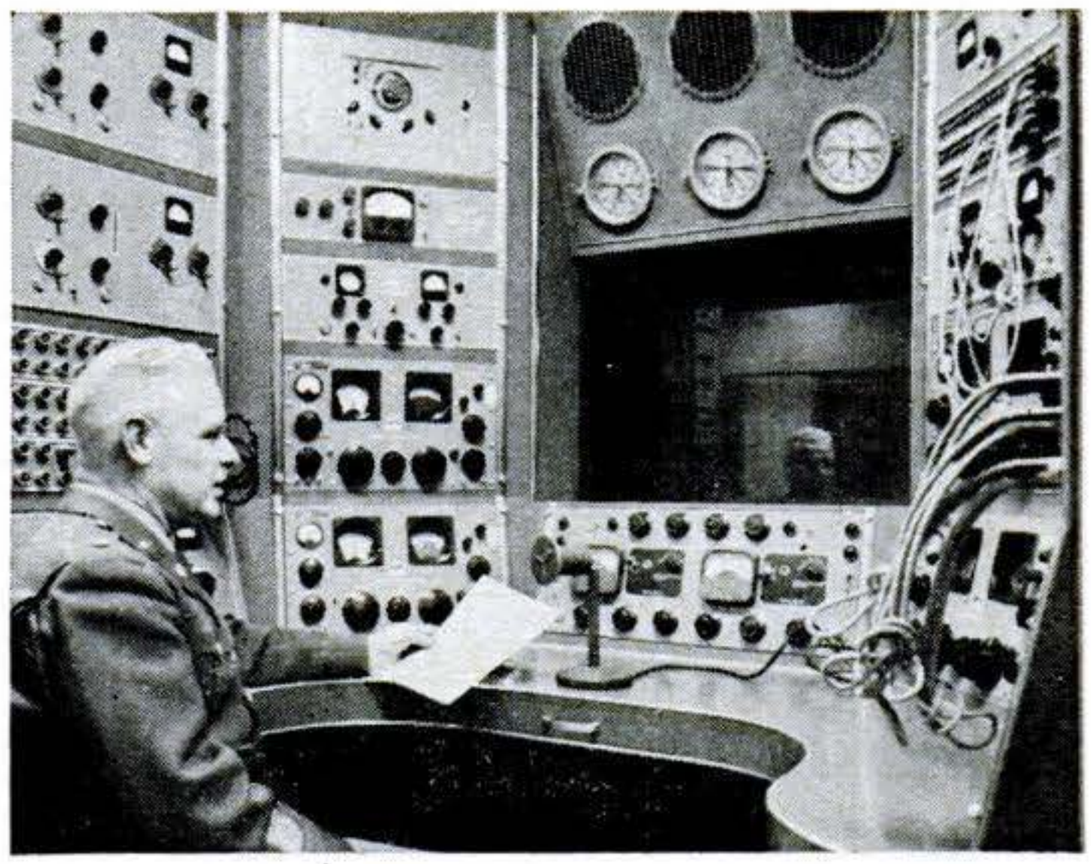
Cougar Jet Has Swept Wings

NEWEST of the Navy jet fighter planes, the Grumman F9F-6 Cougar is shown airborne in a test flight at the left. Successor to the famed Panther, a straight-wing plane, the Cougar has swept wings and a horizontal tail. It is believed to be powered with the same Pratt & Whitney J-48 engine used in the Panther, but is described as much faster. Exact figures are secret, the Navy saying only that it can exceed 600 miles an hour.



Soft Tires Set Off Alarm

THIS automatic tire alarm sounds off with a continuous clicking noise if the air pressure in a tire gets dangerously low. Called the Clix Tire Teller, it was invented by Robert Fidler of Los Angeles. The photo above shows how it is slipped into place under the rim of a car wheel. The alarm weighs three-eighths ounce, and, the inventor says, will not affect tire balance.



Radio Car to Serve President

WHEN the President journeys by special train, a new $119,000 communications car will keep him in two-way touch with world capitals, and with any point in the continental United States. Its equipment (above) includes radiotelephone, coded radio, radiofacsimile transmission and teletypewriter service. It also provides intercommunication between cars of the Presidential train.

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Big Jet Tests Jets

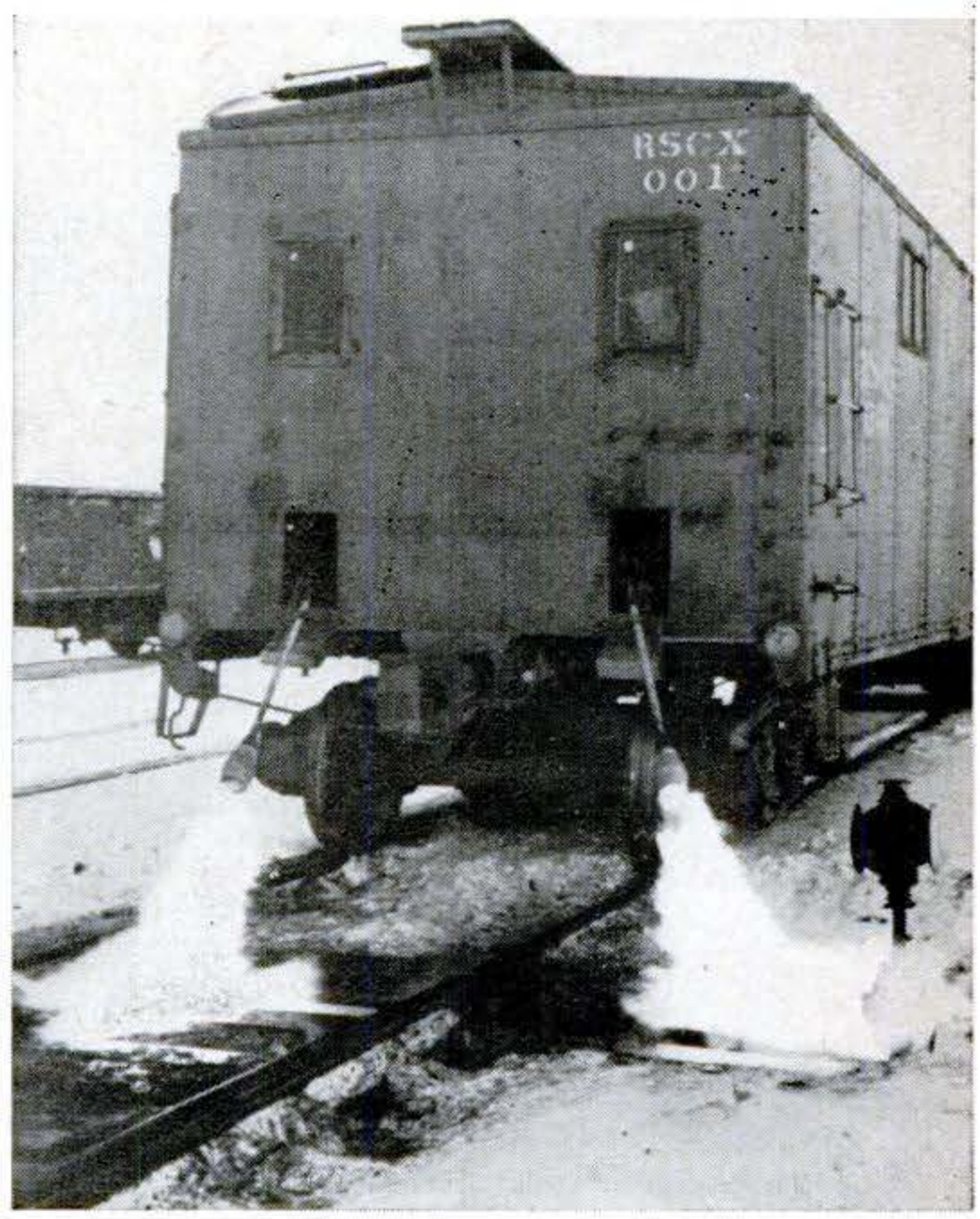
NEW and more powerful jet engines are being flight tested in the four-jet B-45 bomber shown above. A fifth test engine is carried under the bomb bay in a special nacelle that can accommodate turbojet power plants considerably larger than any yet announced. Other Air Force planes on loan to General Electric as flying Laboratories include a B-29 Superfortress and an F-94 jet fighter. The latter is used to test automatic flight-control equipment.

Organ Plays in Silence

PRACTICE makes perfect, but the "noise" often annoys the neighbors—and limits a music teacher to one pupil at a time. Not so with the electronic organ below, invented by a British science teacher. It enables as many as 24 pupils to practice simultaneously—each playing a different piece on an individual keyboard. Each pupil hears only her own playing through earphones. The teacher can listen in on any of the students, speak to them and play back correct versions—also in silence.

Flame Thrower Thaws Switches

FLAME throwers mounted in pairs on boxcars (below) were used this winter to unfreeze railroad switches and crossings covered with ice and snow. Burning Diesel fuel, the big blowtorches opened frozen switches in less than five minutes, as compared with 30 minutes before. Clyde LeBeau of Cleveland developed the system.



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P.S.

Last minute news & notes...

NEWSREELS IN COLOR? Ansco's Negative-Positive film process may soon bring newsreels to your theatre in full color. Ansco says the new process reduces time and cost and eliminates processing difficulties of full-color movie making. It uses a single film carrying three color layers, can be shot in any standard camera and developed fast with regular studio equipment.

A SCALE capable of weighing nearly a million pounds at a time is being made by Fairbanks-Morse for use in connection with the construction of the Air Force's new eight-jet B-52 Stratofort bombers. It will cost $108,000.

SCARWAFS is the name of a new Air Force engineering unit, a counterpart of the Navy's Seabees. Some 500 Scarwafs (Special Category Army With The Air Force) are being trained in the use of some 2,500 machine tools that the Air Force has in storage.

A LITTLE TWO-CYCLE DIESEL with three cylinders has been announced by GM. It's for highway trucks and tractors in the medium-weight class. Rated at 110 horsepower, it has a 16-to-1 compression ratio.

NATURE IS SUSPECTED of resenting competition. Since the workshop of the late Dr. Charles Steinmetz, creator of artificial lightning, was moved to famous Greenfield Village, in Dearborn, Mich., it has been struck four times by natural lightning.

GASOLINE INJECTION is getting a tryout on a Willys station wagon as a substitute for carburetion. Inventor Stuart Hilborn, whose fuel injectors are used on racing cars, claims that there is considerable gas economy.

ADDING FLUORIDES to drinking water, which has been found to prevent dental decay, is now standard practice in 60 U.S. cities. Greatest benefit, scientists say, is to children during the first eight years of their lives. Costing only four to 14 cents per person yearly, the chemical treatment promises a lifetime of healthy teeth at no more than the expense of a couple of dental fillings. In some areas water naturally contains fluoride.

Latest news of the atom...

ELECTRIC POWER from atomic energy is here. The breeder reactor at Arco, Idaho, is turning out 100 kilowatts--enough to light the machine shop and run its power tools. How's it done? All the AEC says is that liquid metal heated in the reactor generates steam to run a turbine, which drives an electric generator.

"HOT" ASHES from atomic furnaces can have practical uses, says the AEC. Feasible applications right now: luminous signs, easier-starting fluorescent lamps, static eliminators. Possible future uses: portable power sources, sterilization of foods and drugs. A number of private firms are planning immediate tests of this last idea.

FEARS of the long-range harm to people injured by atom bombs are partly confirmed by the AEC's latest report on its continuing survey in Hiroshima and Nagasaki. The 1945 atom bombing of those two cities has apparently caused, among people within a mile or so of the blast: a definite increase in leukemia (a fatal cancerous disease of the blood), a very slight increase in the number of babies born deformed, a significant decrease in the percentage of boy babies.

GETTING DRUNK might be a way to avoid radiation injury in an atomic attack. AEC tests show that alcohol helps protect bacteria, mice, flies.

The Editors

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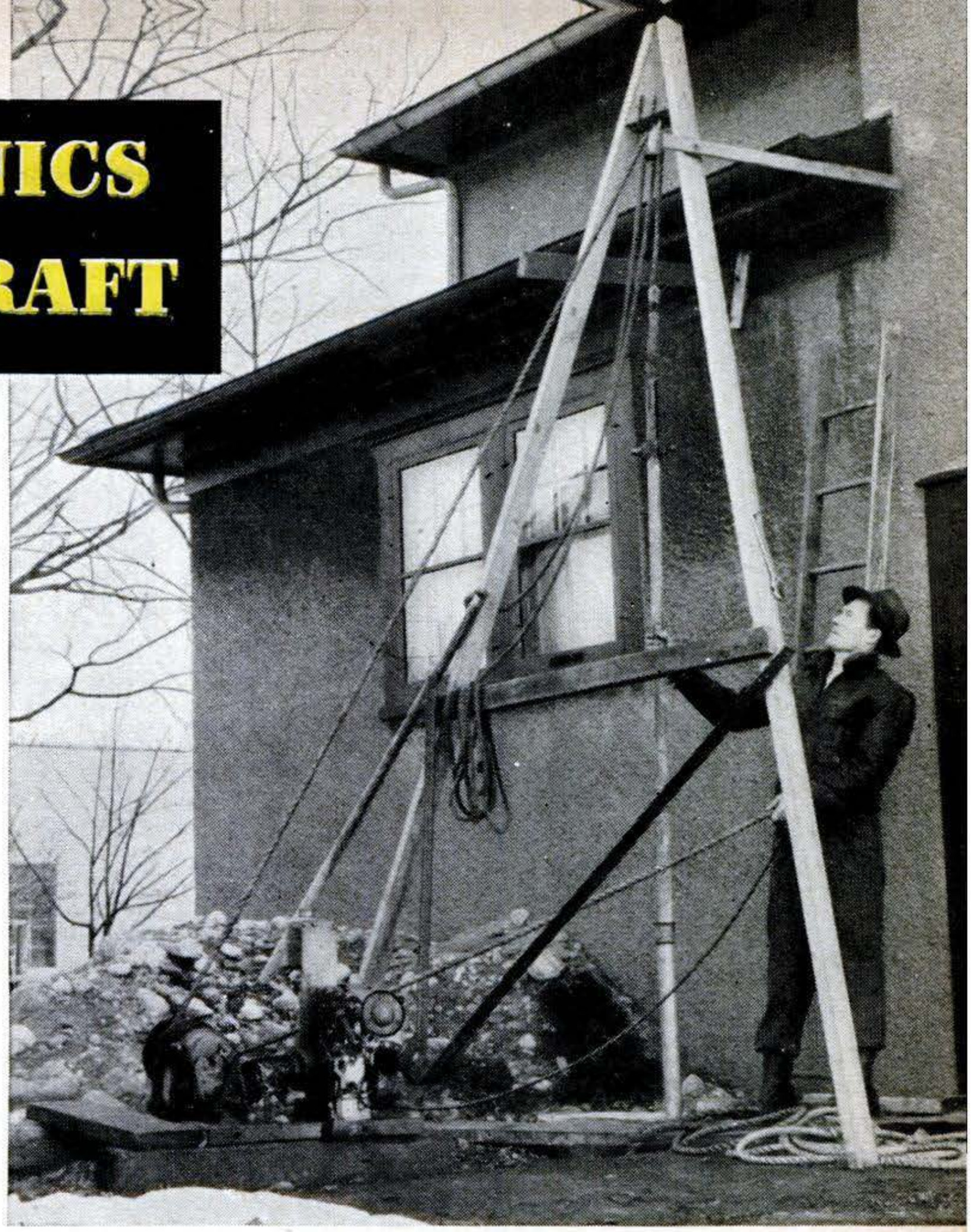
MECHANICS *and* HANDICRAFT
REG. U. S. PAT. OFF.

How I Drilled a Well

PART 1

By E. F. Lindsley



THE RIG. Geared-down engine hoists heavy drill tool when you pull rope wrapped around revolving drum. Easing up on rope lets tool drop. Same tool, with collar bolted on, is also used to drive casing. Second rope is for bail bucket.

A WELL POINT can be driven in loose soils to water-bearing strata with a sledge hammer. Author found he couldn't use it because of rocks.

When the pros get $5 a foot, it's worth thinking about doing it yourself. It may be hard work—but it's also a lot of fun.

WHAT I didn't know about wells when I bought my old country house would have just about filled the platform-covered, stone-walled hole I found in the back yard.

If I had any romantic notions about old oaken buckets, and I must confess I did, they soon fled. The real-estate man had assured me I would be the proud possessor of a good dug well. But he was wrong, very wrong. The well turned out to be hopelessly contaminated from seepages.

To get safe water, a professional driller figured it would be necessary to go down about 35 feet. He would charge a nice round figure of $5 a foot for drilling, plus $25 for installing a pump. The pump and

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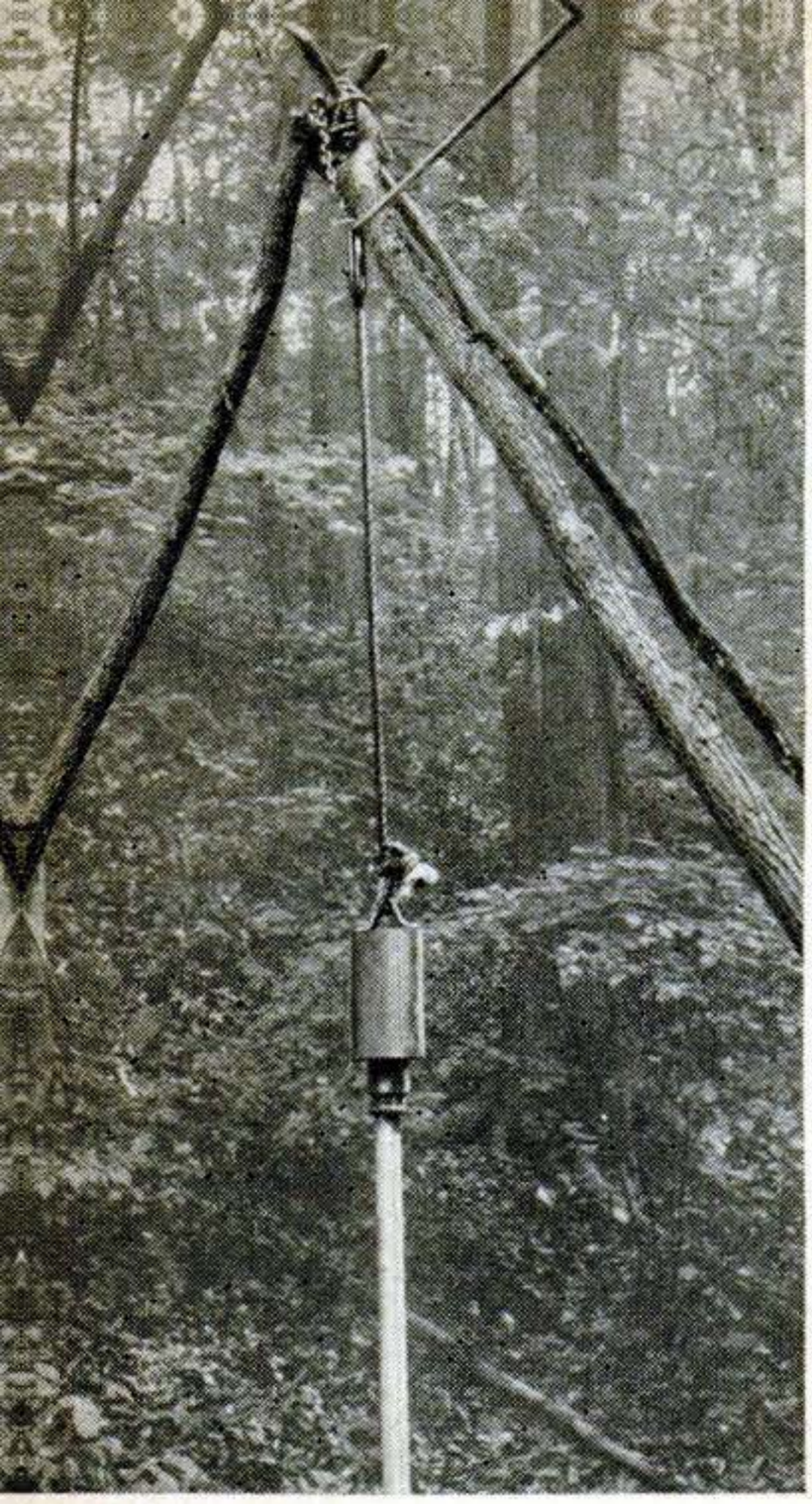
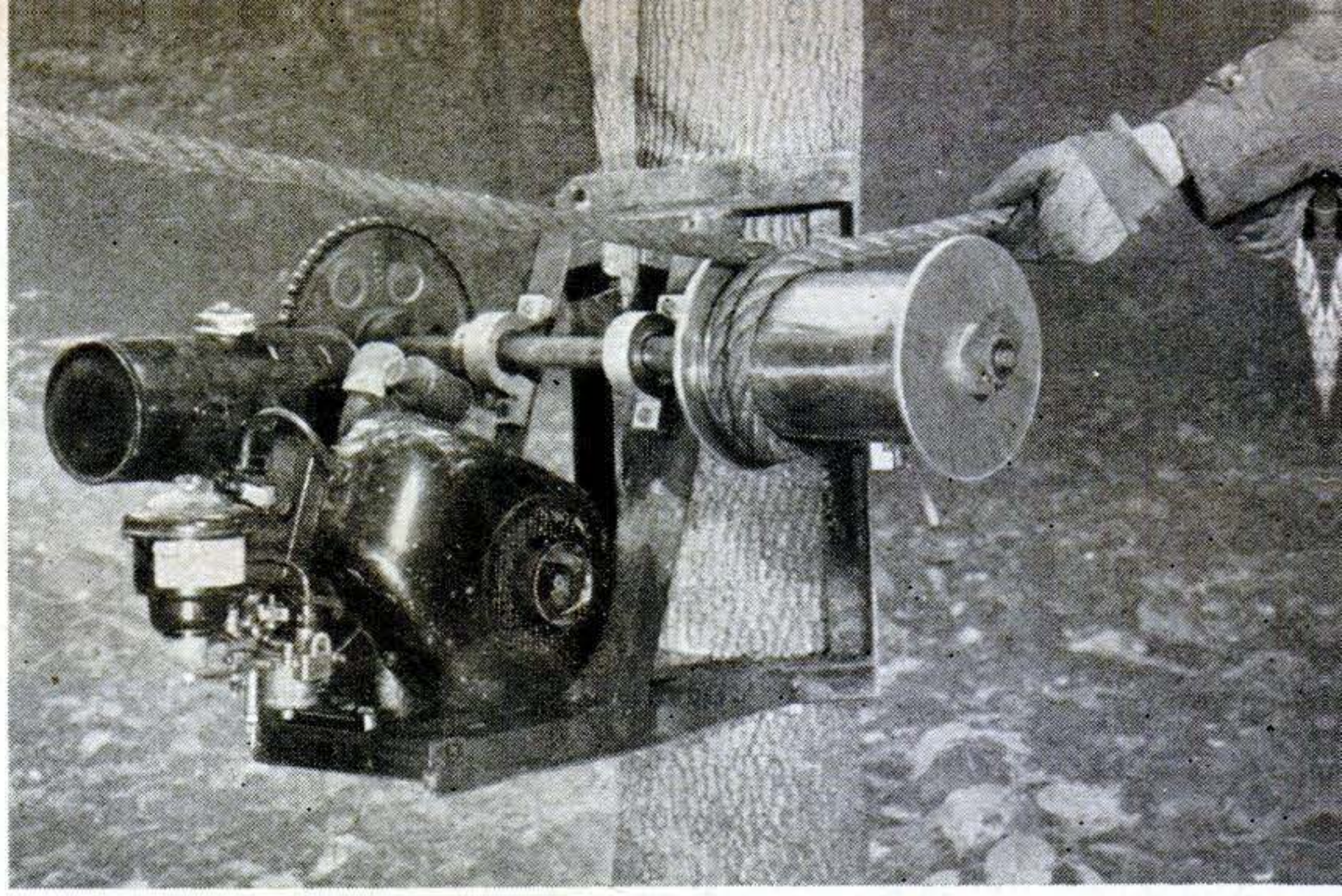




DRIVING A WELL goes faster if you use an engine instead of a sledge hammer. With setup above, W. A. Conway, Macedonia, Ohio, drove a 2″ pipe 23′ deep in three hours. Like author of this article, he wrapped a rope around a revolving drum to get lifting power. Rope runs from drum (above) through a pulley to a weighted driver (left). Pulling rope tight on drum causes engine to raise driver for a driving stroke. One-lung engine,

pipe themselves would cost another $150, raising the total to at least $350—more if the 35-foot estimate proved low.

This was an expense on which I had not counted. There was little I could do about the pump and pipe cost, but I began looking around for some way of paring down the $200 or so that would go for the drilling.

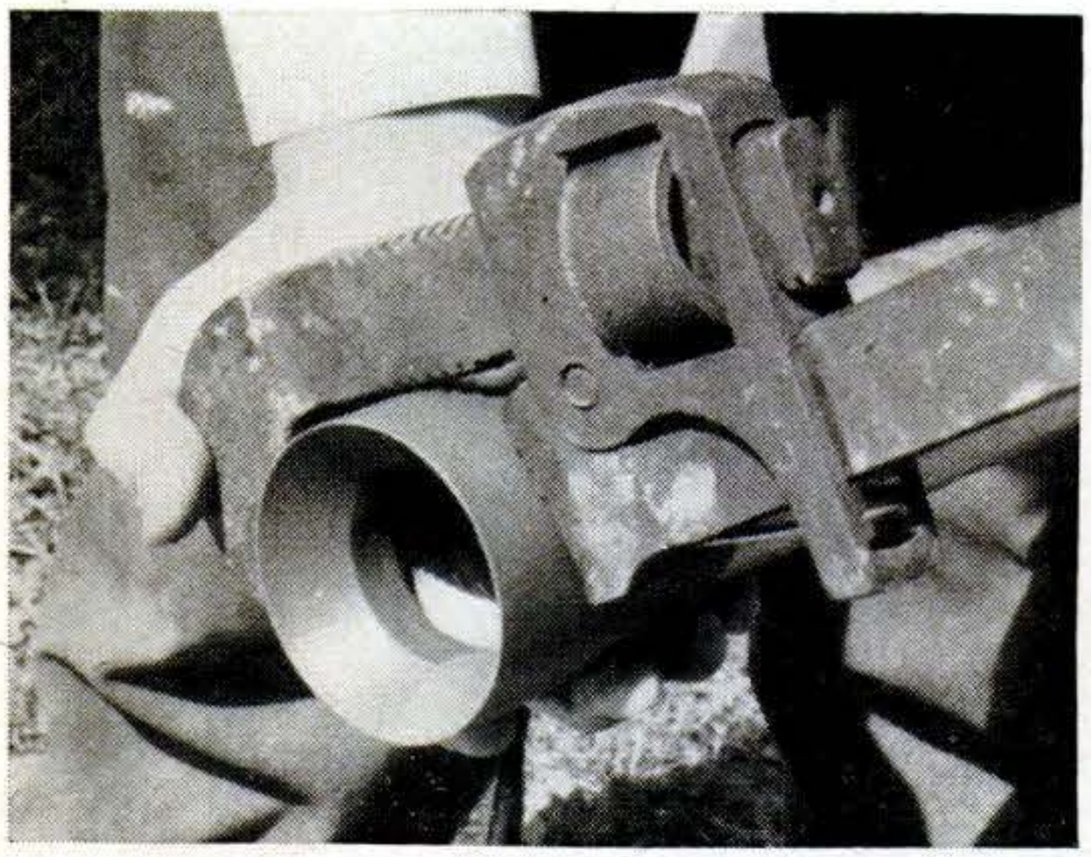
Well point. Somewhere I'd heard about driving a point. This is a 4′ length of heavy-wall pipe with a spear-shaped tip welded on. The pipe walls are perforated to let in water and covered with wire gauze to keep out sand. A drive cap protects the threaded upper end. Successive lengths of pipe are threaded on as you drive the point into the ground. This assembly costs only a few dollars. All I needed was a good sledge, and

E. F. LINDSLEY is a real jack-of-all-trades—and master of them all. PSM readers know him best for auto articles, but he is just as likely to write about installing an oil burner or drilling a well.

Writing for PSM pays just for his cake. His bread and butter come from supervising technical publications for the Waukesha Motor Co.

A college degree in aviation operations, and an A & E mechanic's ticket, carried him to Honolulu as a junior dispatcher—just in time for the Pearl Harbor attack. Later he skipped around the U. S. for Wright Aeronautical Corp., but a year as an associate editor of the old *Scientific American* put him solidly into the writing business.

If you're ever in North Prairie, Wis., look up the local justice of the peace. That'll be E. F. Lindsley.



SHARP DRIVE SHOE of tough metal was threaded on bottom of casing to speed cutting and withstand impact. The author obtained this from plumbing-supply house. Failure to use such a shoe can result in split or collapsed casing deep in ground. For easier handling, standard 21′ lengths of 2″ casing were cut in half, then threaded. Author used heavy-duty well couplings after a friend had casing break because of small plumbing-type couplings. A drive shoe funnels soil to inside of casing.

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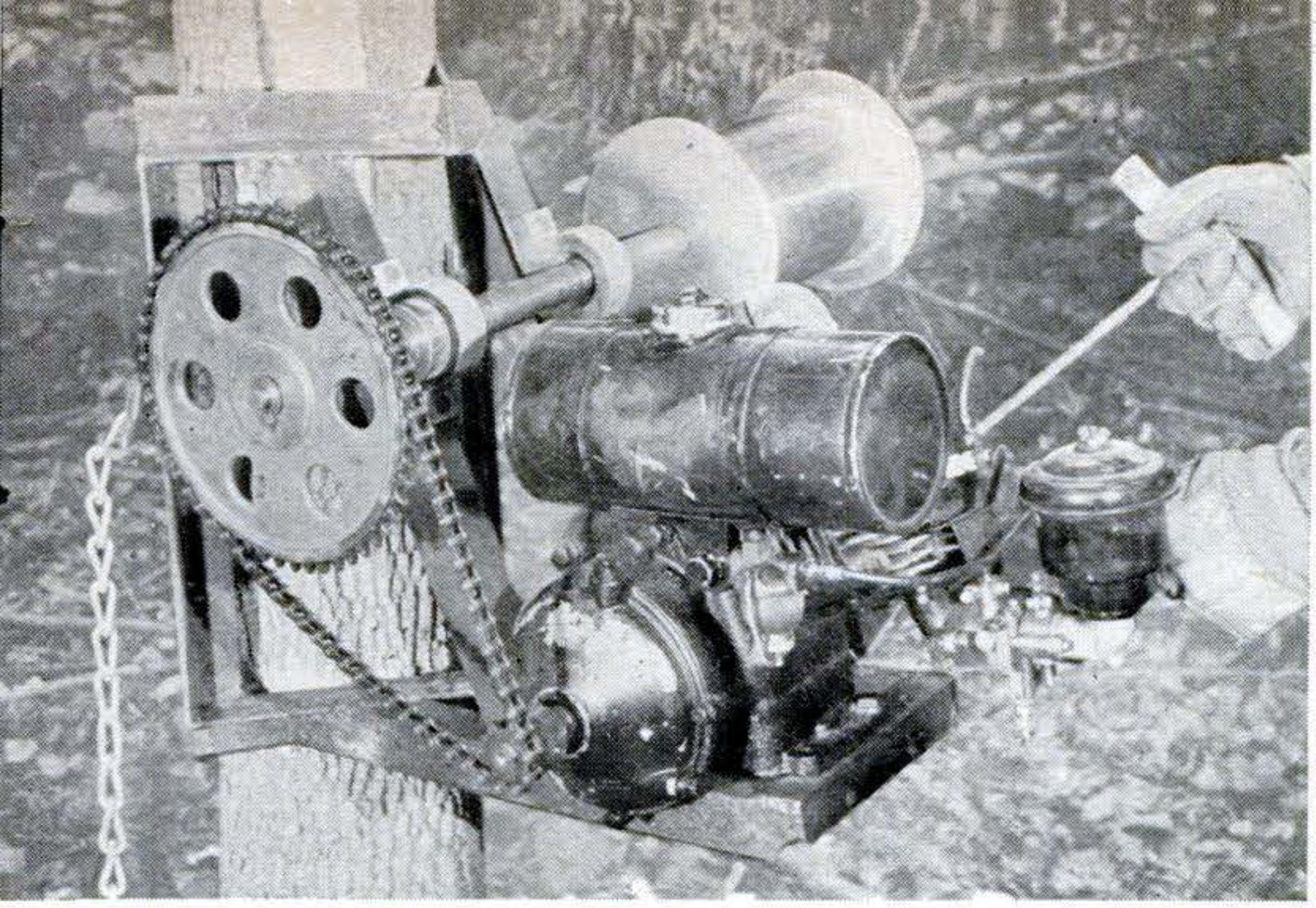

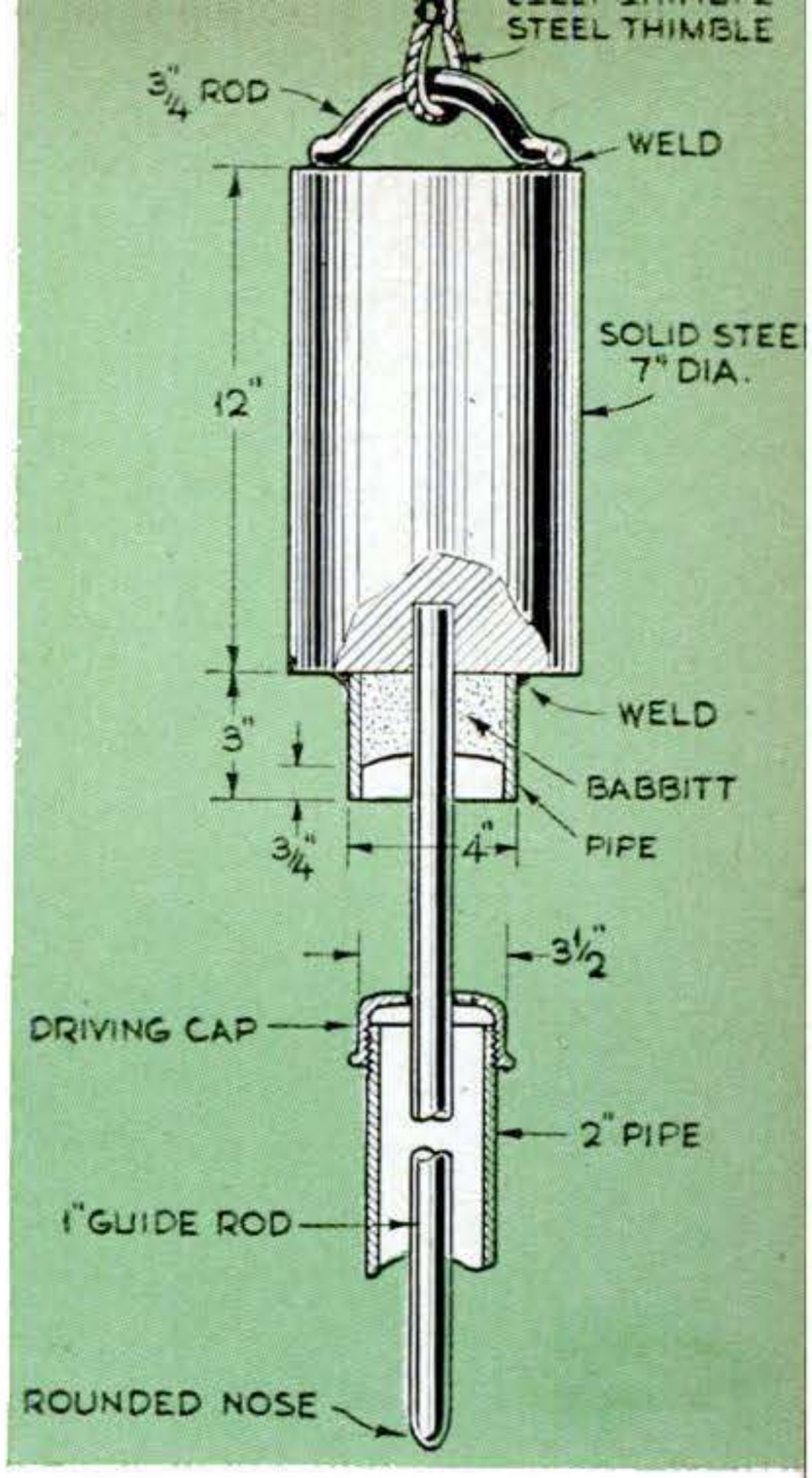

rope-started as above, operates drum at about 100 r.p.m. through a chain-and-sprocket reduction drive. For this job, welded angle-iron frame that supports power unit was chained to a convenient tree. Drawing at right shows how 1" guide bar welded to bottom of 125-lb. weight slides up and down in a hole in heavy-duty drive cap screwed to top of pipe being driven. Driving a well is practical only in loose soils.

perhaps a helper, to drive the whole works down. For a time, I congratulated myself on having found the ideal solution to that problem of saving $200.

Then I learned my first lesson: Always check on local geological conditions before attempting to drive a point. I learned that points are common within a few miles of our village, but that a deep layer of glacial stones would make it almost impossible to put one down in my yard. The point would either whack into a big boulder and stop dead, or it would start to weave its way past the boulders until the drive pipe broke or the friction got so high that further driving became impossible. Old-timers also wondered what I would do about pumping the water if I had to go beyond maximum shallow-well

Pros and Cons on Two Main Kinds of Domestic Water Wells

DRIVEN WELL

Inexpensive. Costs only a few dollars for point and pipe.

Limited use. Most soils are too tough to drive a point beyond shallow-well depth (22′ to 25′). Rocky soils will stop point cold or bend it.

Pumping problems. Most points are 1¼″ pipe, or less. A 2″ point is a heroic job to drive. Shortness of drive-pipe sections, and stones, cause bending of pipe so it is often impossible to install a suction pipe and foot valve. Also, 2″ pipe is about minimum for standard jet and valve fittings. Sucker rods and cylinder pump will not work in bent pipe.

Limited water sources. Point is very hard to drive through hardpan or other dense layers which must be penetrated to seal off surface water.

Difficult servicing. A clogged point, or one with outer screening filled, is almost impossible to clean.

DRILLED WELL

Higher cost. Professional well with 6″ casing is costly because of labor charge. Home-drilled job costs only a little more than drive pipe and point, but desirable extra suction pipe will cost few dollars more.

Wider use. Sandstone and packed gravel can be penetrated with drill. Smaller rocks and boulders can be broken up. Home driller can reach deep-well depths in most areas.

Use most pumps. Professionally drilled wells will take any pump including submersible type. Home-drilled of 2″ size and over take reciprocating pump, sucker rods and cylinder, or jet pump.

Better water. Best water is ordinarily found below dense formations where point is hard to drive. These formations seal off well, keeping out silt and sand.

Easy servicing. Big casing and straighter opening permit entering well with tools for cleaning out silt accumulations, or for deeper drilling if water table drops.

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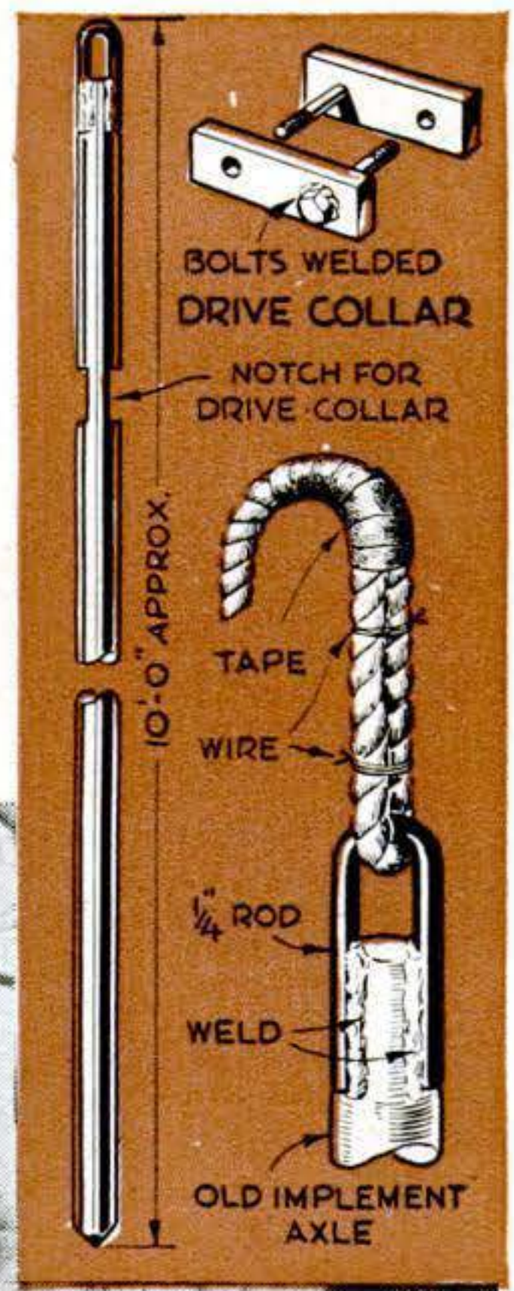
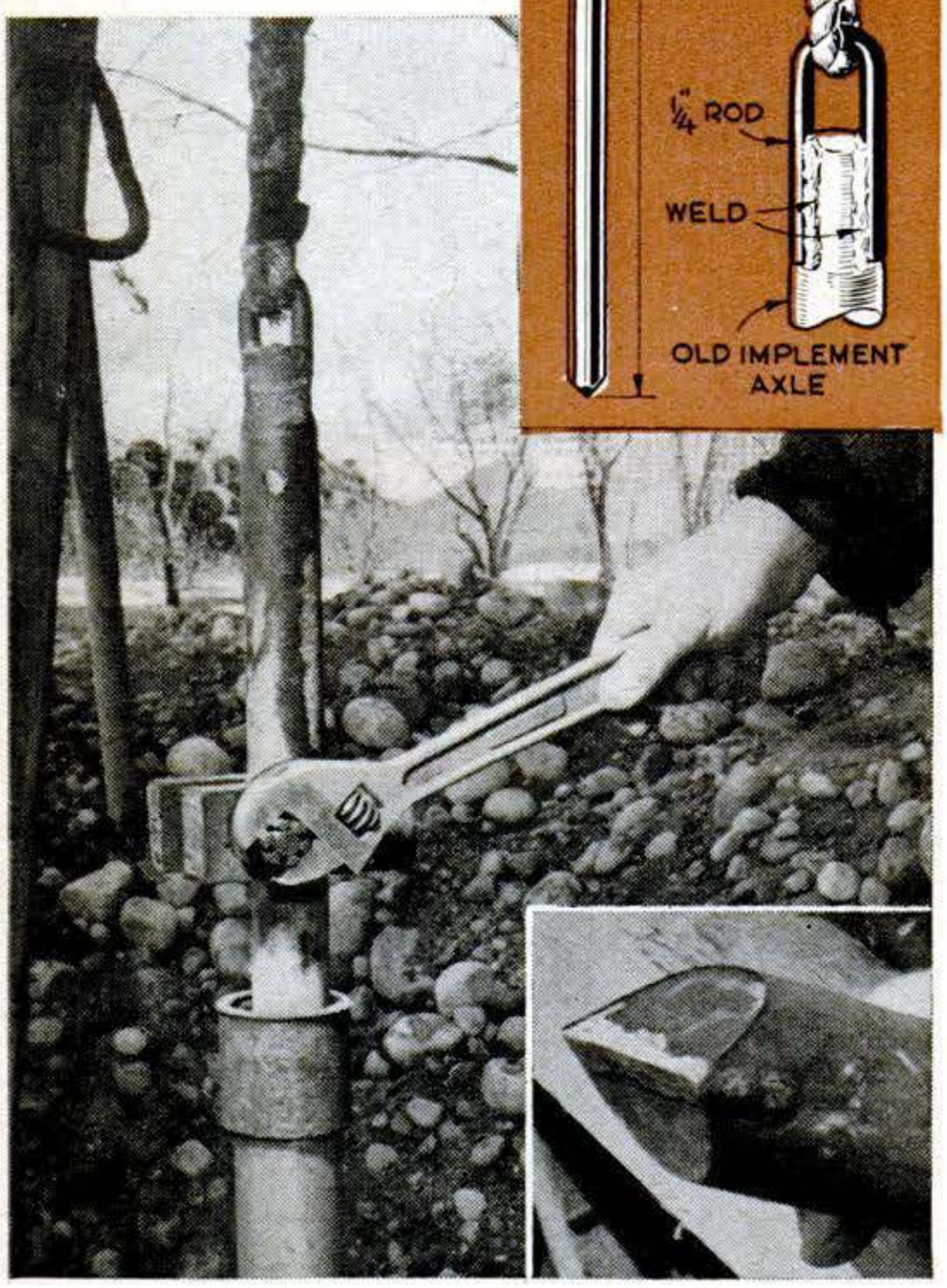
DRILL TOOL was made from a 10′ length of farm-implement axle. Eye welded on top end takes rope. Chisel end (inset below) is not necessarily best, for it tends to glance off round stones. Flared, plain blunt, or diamond-shaped points all work; which is best depends on ground. A collar bolted on 100-lb. tool was used to drive well casing.





depth—about 25 feet below the pump under ideal conditions.

Beyond suction depth. This was a problem I hadn't thought about, and I quickly gathered together a small library of well-pump and well-equipment catalogues. I found that either a cylinder or jet pump for use beyond pure suction depth would require some sort of cylinder or jet down *inside* the drive pipe below the water level. Such cylinders and jets aren't commonly made for anything smaller than a 2″ pipe. The thought of hammering a 2″ well point far into the ground lost its charm. It became even less attractive when someone who had suffered through the experience asked me what I was going to do, assuming I did get a 2″ point through the stones, if the pipe bent enough to prevent the well cylinder or jet from passing down into the water.

About this time, I consulted the village sages on the merits of a gas-powered drilling rig. I was told to talk to one of my neighbors, a fellow named Larry, who had made a drill rig that put his well down 40′ through rocks and all.

Driving vs. drilling. A new concept dawned on me. When you drive a point, it will seek its own course. When you drill a hole, you make that hole go straight and where you want it in the size you want it.

The obvious advantages of a drilled well were more attractive to me than gambling on a successfully driven point. The next problem was to find out just what took place in the process of "cable-tool" drilling. (This is lingo for whanging away with a dropped or hammered bit that is supported by a cable or rope. It is a beefed-up version of the familiar star-drill-and-sledge attack on concrete and should not be confused with the rotary-drill methods used on oil wells and other deep holes.)

Since a water well must be sealed against the influx of ground water and pollution, it must be cased with a pipe. Thus, the problem becomes one of drilling a hole and driving the pipe into it, or driving the pipe as far as possible and drilling the material out of its center. I found the latter procedure a better one for the amateur because of the danger of getting the tool stuck when drilling ahead of the casing. In either case, material pulverized by the tool is mixed with added water and then bailed out.

Equipment. My drill tool was made from a 10′ length of 1¾″ steel shafting that I scavenged from some farm equipment. A chisel end with a hard-surface material arc-welded on works well when striking squarely on a stone. My first method of attaching the rope to the upper end of the 100-lb. tool —through a nicely fitted clevis with a bushed eye for the rope—didn't stand up. A simple welded loop with the rope run through and lashed with wire and friction tape was best.

Most professional drillers use a separate driver to hammer the pipe into the ground. But I found it practical to use the drill tool as a driver, too. At first I tried a ⅝″ hole drilled through the upper shank of the tool with a short length of bar stock run through, like the cross of a T, to strike the drive collar. This lasted about five minutes.

So I cut square notches in the shank and attached rectangular chunks of steel with

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bolts. Ordinary bolts didn't work, and heat-treated connecting-rod bolts were substituted. The bolts were welded in place to save holding two wrenches, one of which always wanted to fall into the well pit.

Bailer. My next concern was a slush bucket, or bailer. This is a tubular bucket with a one-way valve at the bottom. The bucket is lowered into the soupy "slurry" of pounded-up rock particles at the bottom of the casing and then is quickly hauled up while the check valve prevents the mud from running out.

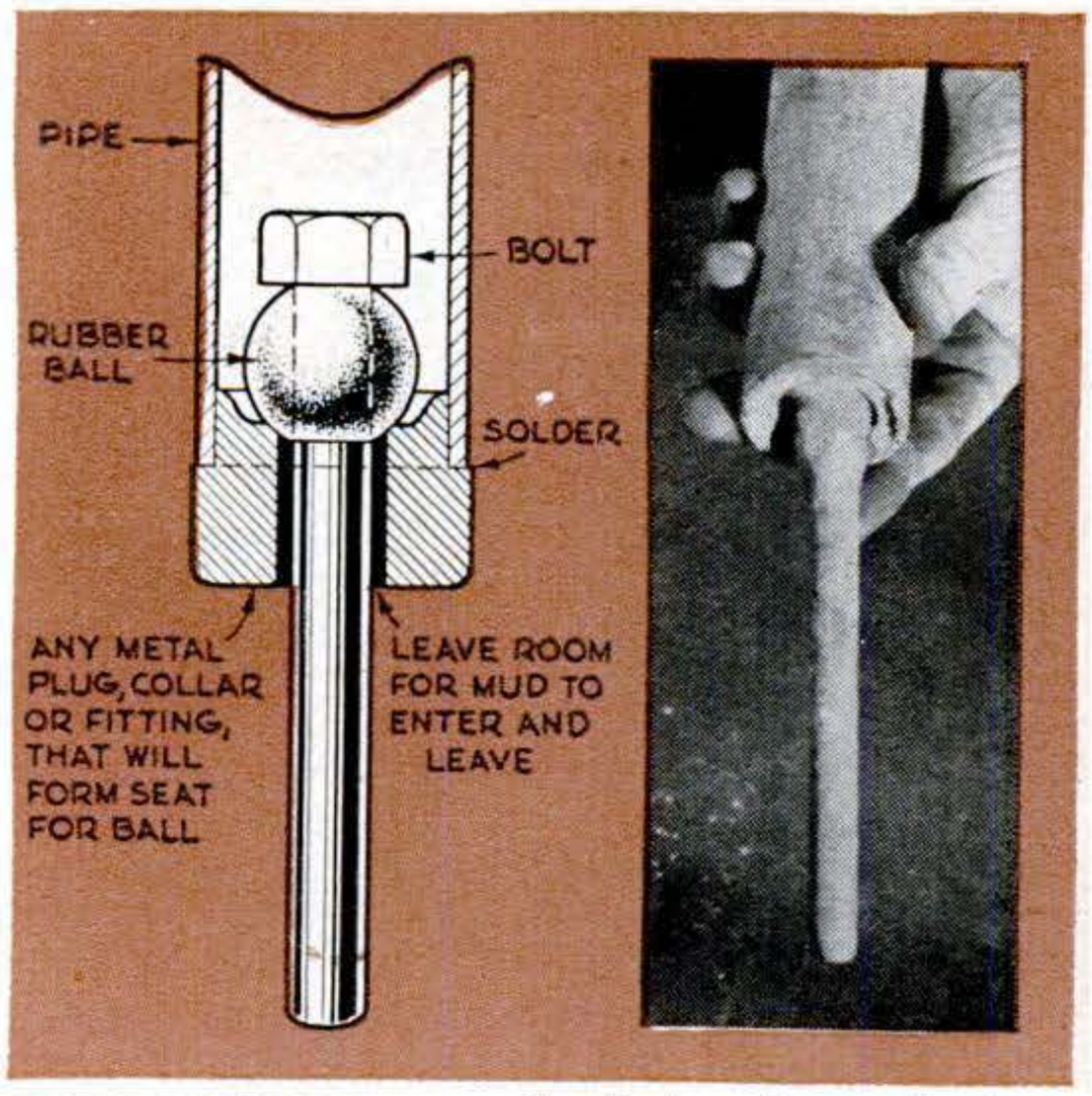
Any piece of pipe or tubing that fits in the casing will make a slush bucket. A loop or eye at one end is necessary to attach the rope. A ring-shaped valve seat at the lower end can be made from a drilled-out pipe cap. Weld or braze the valve seat in place. The valve can be a large engine valve or, like mine, a long bolt run through a sponge-rubber ball.

The important thing is for the valve to fit loosely enough for the thick mud to pass between the valve seat and stem. Also, the seat must offer a fairly sharp edge for a seal or the valve will wedge open with bits of stone. A heavy valve is best, but remember that the bucket must lift off the bottom of the hole for the length of the stem before the valve seats. Too long a stem means that the tool will not pick up mud close to the bottom. And too much bottom mud reduces the impact of the drill.

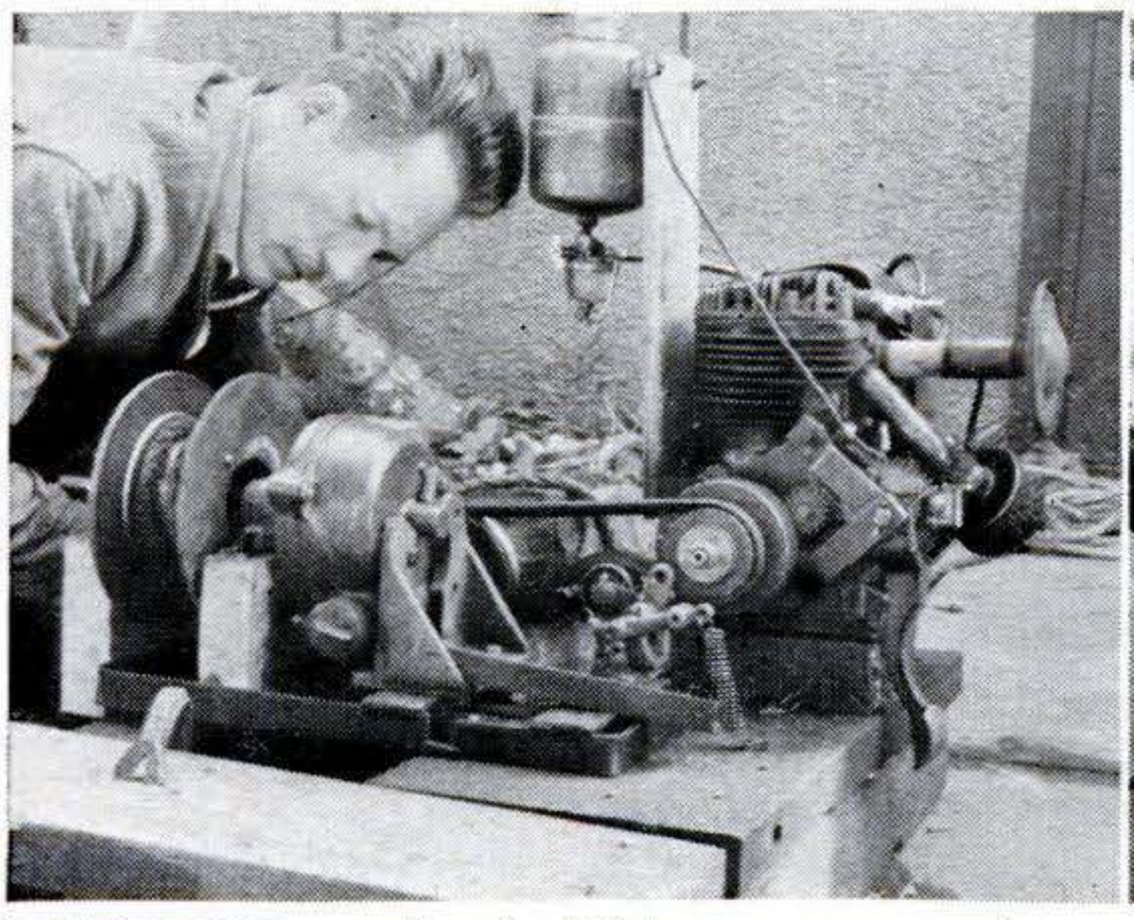
Drilling. Naturally, the major portion of my job was building a rig. What was needed was a drum hoist with adequate power to lift several hundred pounds easily for hours on end. The principle consists of taking two or three turns around the drum with the rope, which is free to slip on the drum until you apply tension to the free end. When you alternately pull and release the rope the tool is lifted and dropped, producing the action of a pile driver.

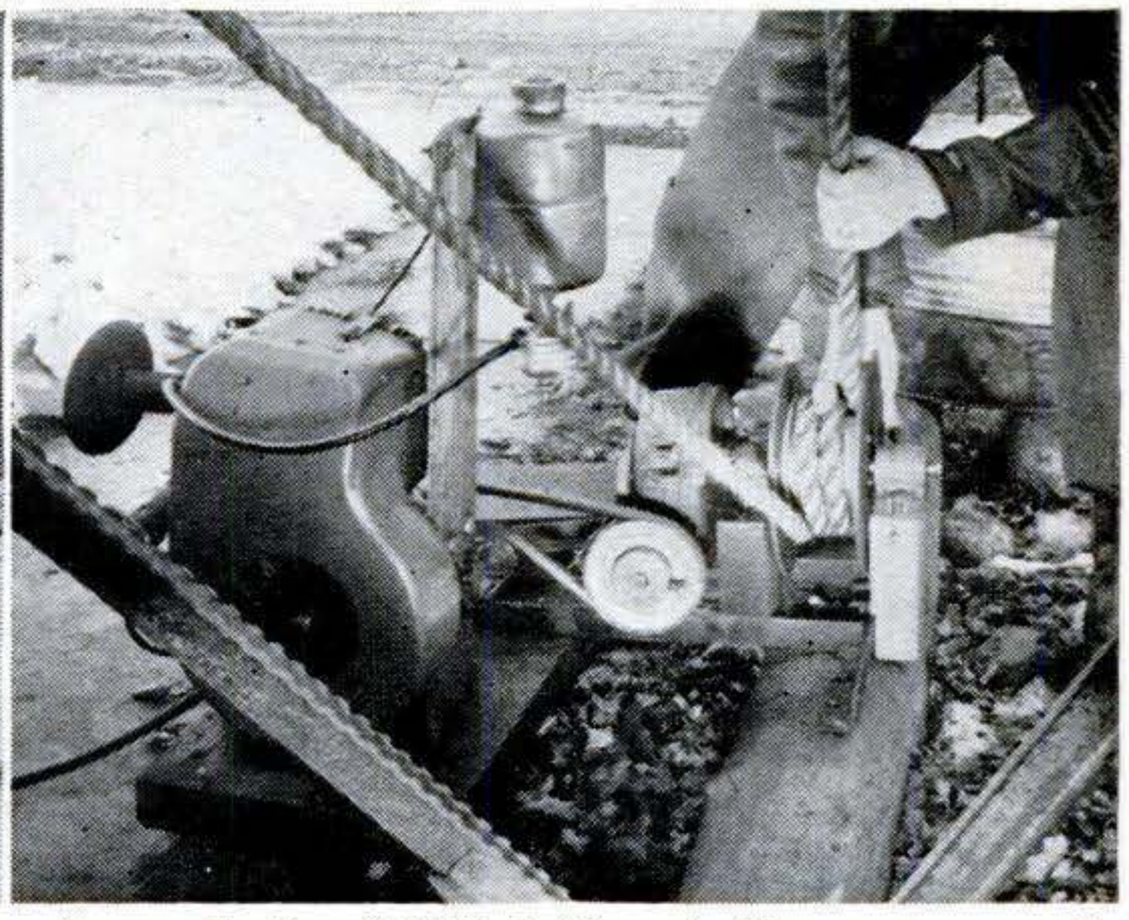
Starting with a 4-hp. scooter engine, which I figured could be operated safely at a continuous speed of 2,000 r.p.m., I considered several methods of speed reduction

[Continued on page 268]



SLUSH BUCKET was made from piece of pipe. Valve in photo is a bolt with metal brazed on. The author later made another bucket with a rubber ball as the valve. A hole was drilled through ball and a bolt pushed through it.





POWER UNIT consisted of 4-hp. scooter engine, equipped with centrifugal clutch and old washing-machine worm drive. This gave a speed reduction of about 19 to 1. Saw-mandrel bearings mounted on maple blocks support drum shaft of 5/8" drill rod. Drum was made by building up sides of pulley with disks. Drum was locked to shaft with soft-iron shear pin. Base was made for power unit by bolting an old refrigerator frame to wooden skids.

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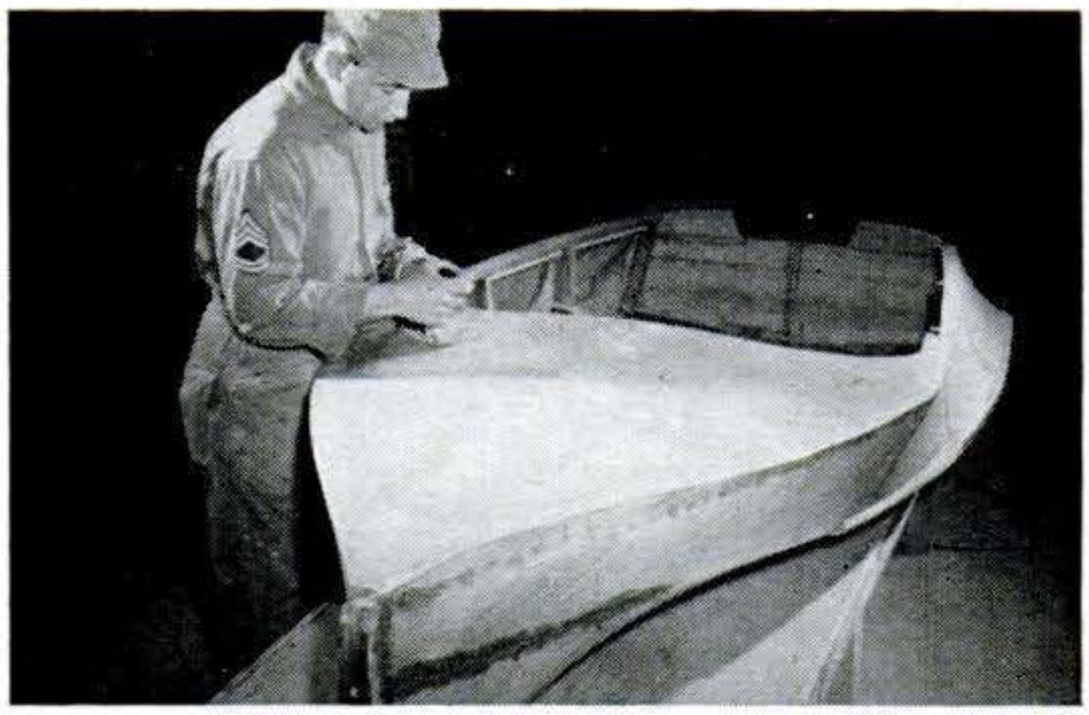
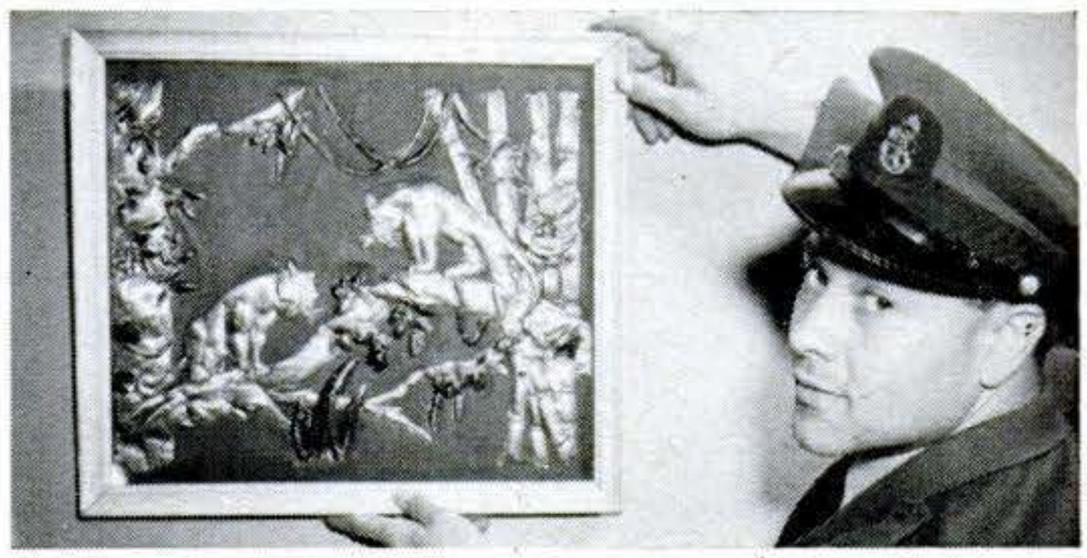
CRAFTSMEN IN UNIFORM

Fliers Design Luxury Car. Capt. Bill Cunningham and his brother, Cpl. Don (at the wheel) spent a year building this $8,000 car. The Cunninghams, who are pilot and crew chief with the 113th Fighter Interceptor Squadron, Scott Air Force Base, Ill., restyled the body of a 1940 Mercury convertible. To it they added the engine and transmission from two late-model Lincolns, a two-speed rear axle, dropped front axle,

Navy Airman Wears Radio. Aviation Technician John Maykut Jr., Norfolk Naval Air Station, parks a radio in his hat. Using parts from old radios, he assembled a five-tuber on a sun helmet. The dangling wires connect to batteries in his pocket.



Outboard Runabout. T/Sgt. William Hasty, Mitchel Air Force Base, N. Y., uses a portable belt sander on his 8′ 6″ half-deck speedboat. The deck and hull are made of mahogany, transom and floor strips are oak, and the spars are walnut.



Copper Bas-Relief. Pictures by Navy Chief Aviation Machinist Joseph Hazard combine drawing and sculpture. He sketches a picture on the back of a soft copper sheet, and then retraces the outlines with embossing nibs to make the figures stand out.

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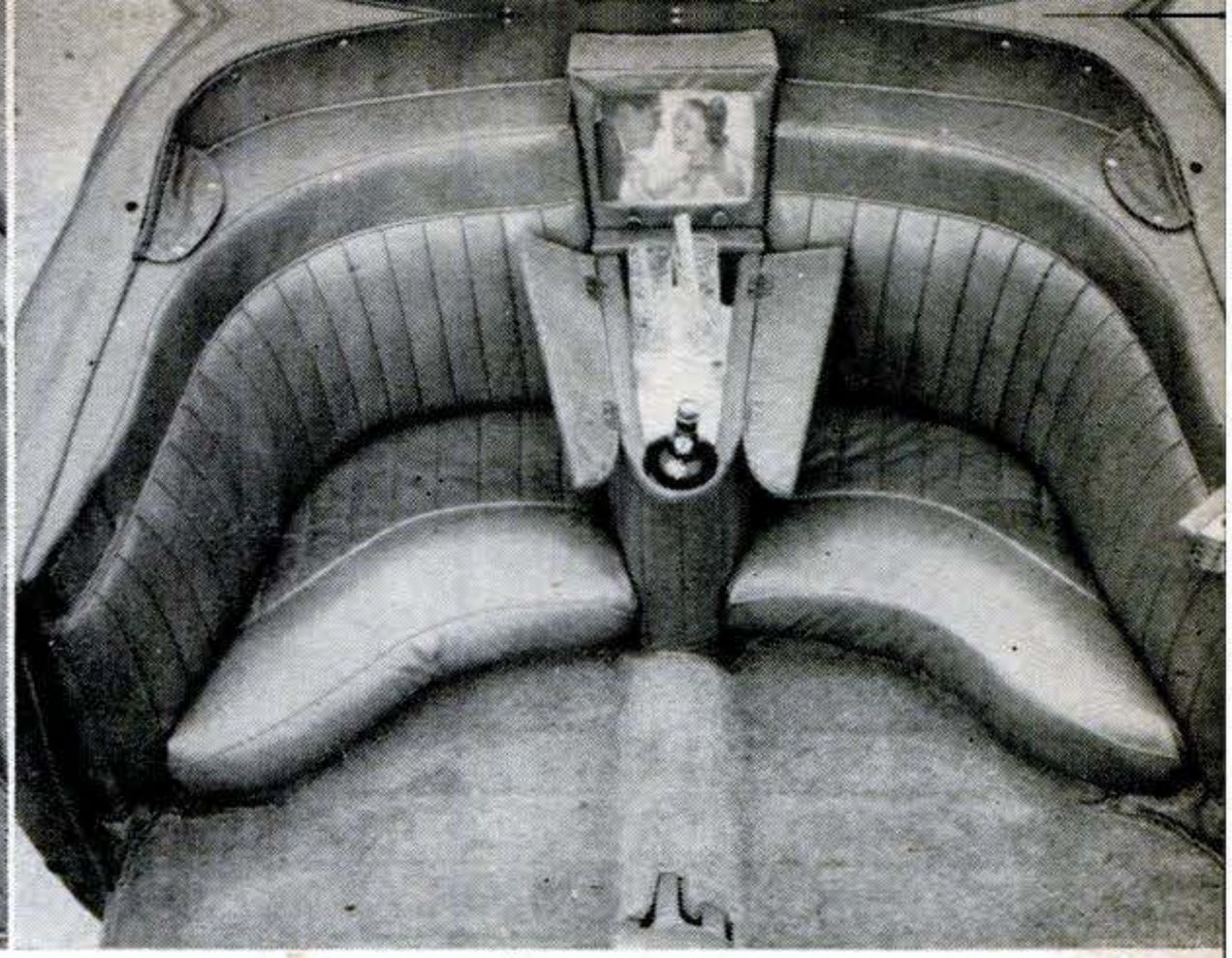

and dozens of other body and engine modifications. The interior is leather-upholstered and the front passenger seat swivels so everyone but the driver can get a clear view of the television enclosure that divides the two rear lounges. The rear armrest opens into a cocktail bar. A padded, leather-covered dashboard and a "pop-out" windshield are among the car's safety features. The hard top is removable.

Craftwork Pays Off for Members of the Armed Forces

Riding his craft hobby during off-duty hours will earn some serviceman the King Midget car at right.

CRAFTSMEN IN UNIFORM, the new feature on these pages, will appear throughout the summer. It will consist of photographs of craftwork by men on active duty with the armed forces.

POPULAR SCIENCE MONTHLY will pay $18.75 (the price of a U.S. defense bond) for every contribution accepted for publication in this department. And the manufacturers of the King Midget will send one of the little cars to the contributor of the item, received before August 1, 1952, which the editors consider the most interesting example of craftwork by men or women on active duty with the armed forces.

The King Midget is the one-cylinder, two-passenger, 500-pound car shown on the cover of POPULAR SCIENCE MONTHLY last November. It will be shipped to any address within the continental limit of the United States specified by the recipient.

Photographs and explanatory captions for this department should be addressed to the Craftsmen-in-Uniform Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Ave., New York 10, N. Y. Do not send anything except photographs and descriptive information. Although every effort will be made to return contributions accompanied by return postage, PSM assumes no responsibility for this. The editors will be the sole judges of the material chosen to be printed, and the item chosen as the most interesting, and their decisions will be final.

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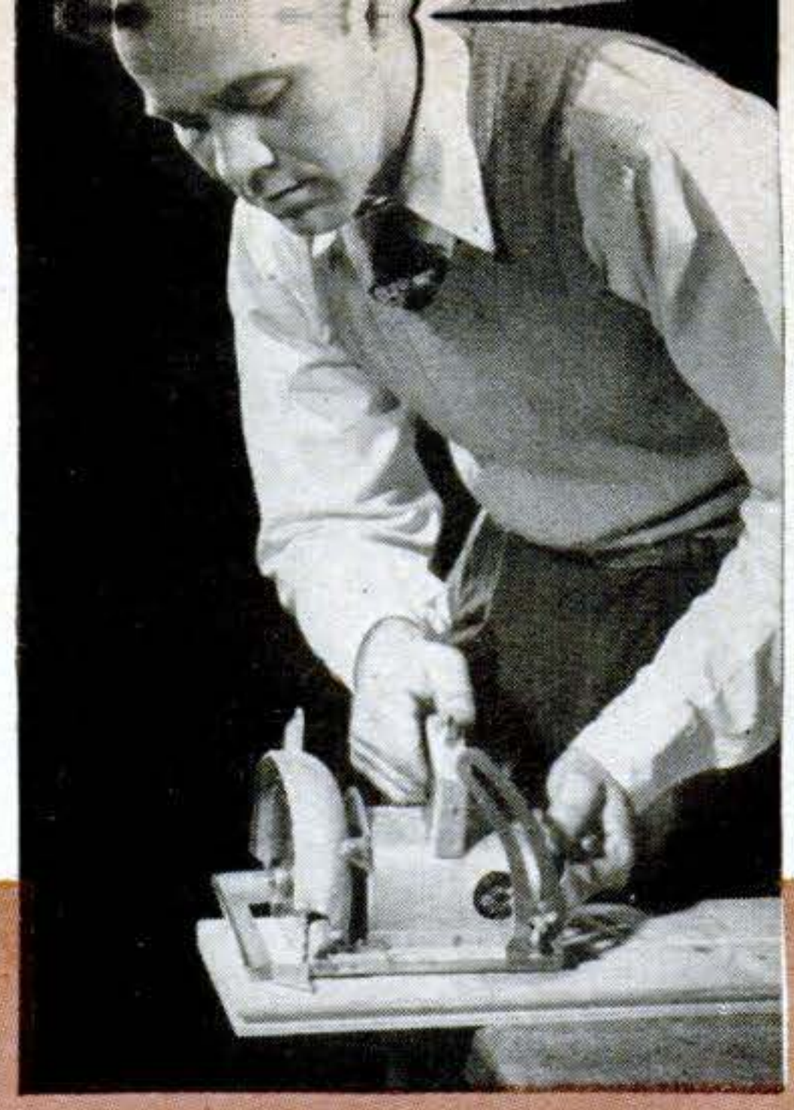
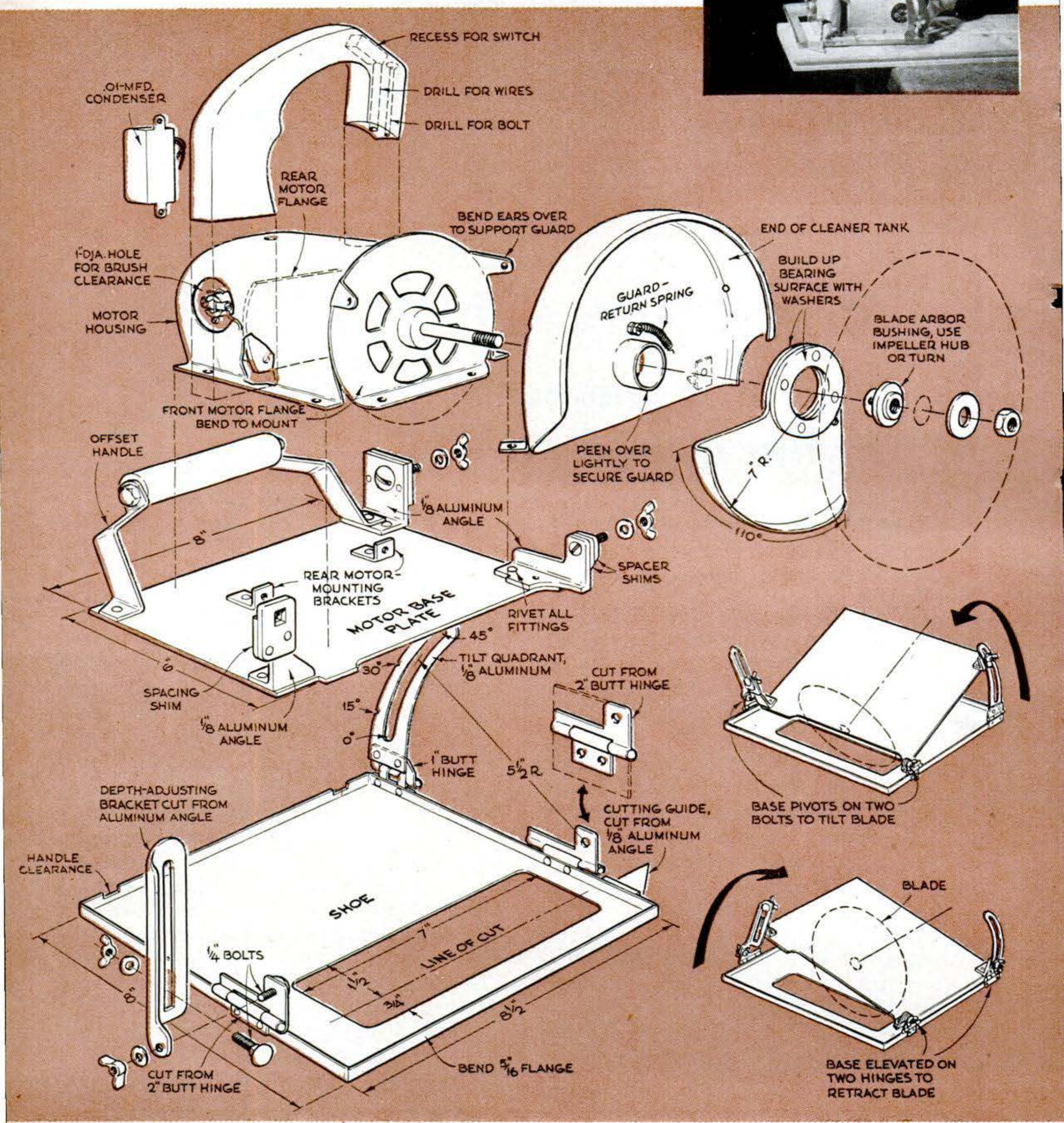
Building a Portable Electric Saw





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Spare the elbow grease by hitching a tireless electric muscle to your sawing arm. The motor from a tank-type vacuum cleaner will swing a six-inch blade for straight cuts, bevels or dadoes.

BECAUSE it is light, tough and powerful, the motor from a tank-type vacuum cleaner is made to order for use in a home-built portable saw.

Specifications on this nifty buzz-cutter are really impressive. With a 6¼″ blade, it has a maximum cutting capacity of 1⅞″, enough to slice through a two-by-four. The blade retracts to ½″ for shallow cuts or dadoes. On a 45° bevel (the maximum) it cuts to a depth of 1⅜″. Although the motor has ample power to march through tough cuts, I figure that it's working harder than it did as a vacuum cleaner, and so I give it occasional cooling rests on long ripping jobs.

The double hinging necessary to provide tilt and adjustable cut depth sounds complicated but is simple. The motor is mounted solidly on a base plate. This is hinged to another plate, which I call the shoe, that rides on the work. Hinges and pivot bolts let the motor plate be tilted in one plane for angle cuts and in another plane for varying the depth of cut.

Checking the motor. Not all tank-type vacuums have husky enough motors. Try to get one rated at about 650 watts (5.5 amperes); the light-duty ones won't swing the blade satisfactorily. If you shop the used-cleaner stores, be sure the motor is in good condition, or capable of being restored to it.

Take the motor apart, brighten the commutator and undercut the mica spacers if necessary. Check the brushes for wear, lubricate the bearings lightly and reassemble. The shaft should have no end play.

On the motor shown, the front mounting flange was bent 90° to level it with the bottom edge of the rear flange. Two angle brackets were then bolted to the rear flange for mounting on the base plate. If your motor differs, you may have to improvise other mounting methods. Check to be sure that the armature is as near the base plate as possible, and exactly parallel with it.

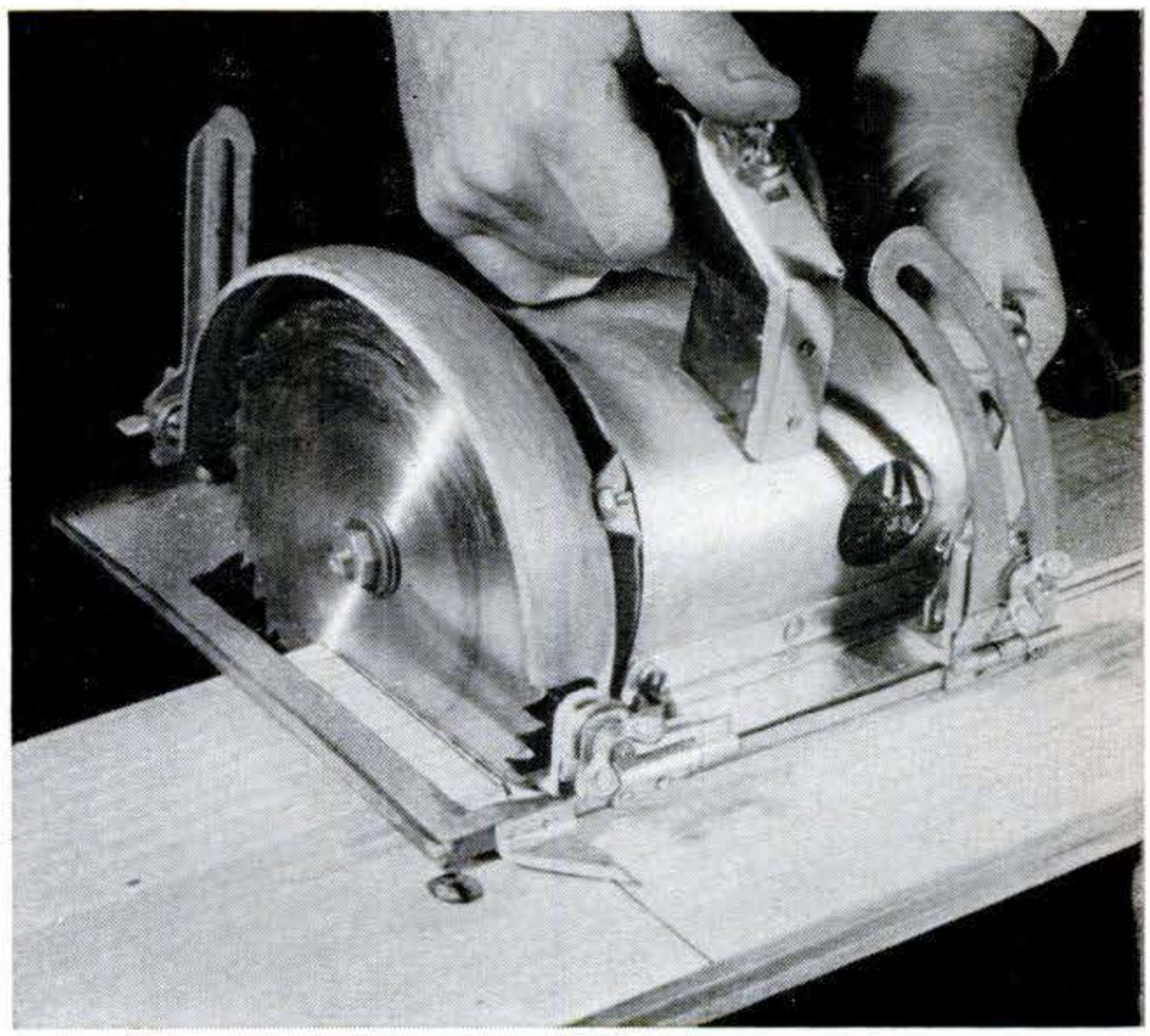
Base plate and shoe. The undercarriage of the saw consists of two parts: the shoe, which slides over the work, and the base plate, which supports the motor. Cut both from 16-gauge (1/16″) dural. Mount the motor on the base plate with flush rivets. Bend the edges of the shoe up to form a flange on four sides.

Tilt and depth fittings. Saw one leaf of two 2″ steel butt hinges to the L shape shown, and rivet these and a shorter hinge to the shoe. Be sure to line up the holes in the ears of the long hinges. Rivet a slotted quadrant to the movable leaf of the third hinge. If you can't find a suitable quadrant, file one from dural.

Pivot a straight slotted member to the rear hinge. The mounting ear of this piece must be bent to bring the slotted face at right angles to the hinge pin.

Fittings on the base plate can be made from aluminum angle, strap iron or parts of hinges. Those at the front edge are mounted parallel to the hinges below them. The rear bracket must be mounted parallel to the slotted member.

Build or shim up the faces of the base-



CUTTING OFF. Here the base plate rests flat on shoe, extending blade 1⅞″, the maximum cutting depth. Beveled pointer can be guided along line freehand with fair accuracy, or fence can be clamped on work for exact cuts.

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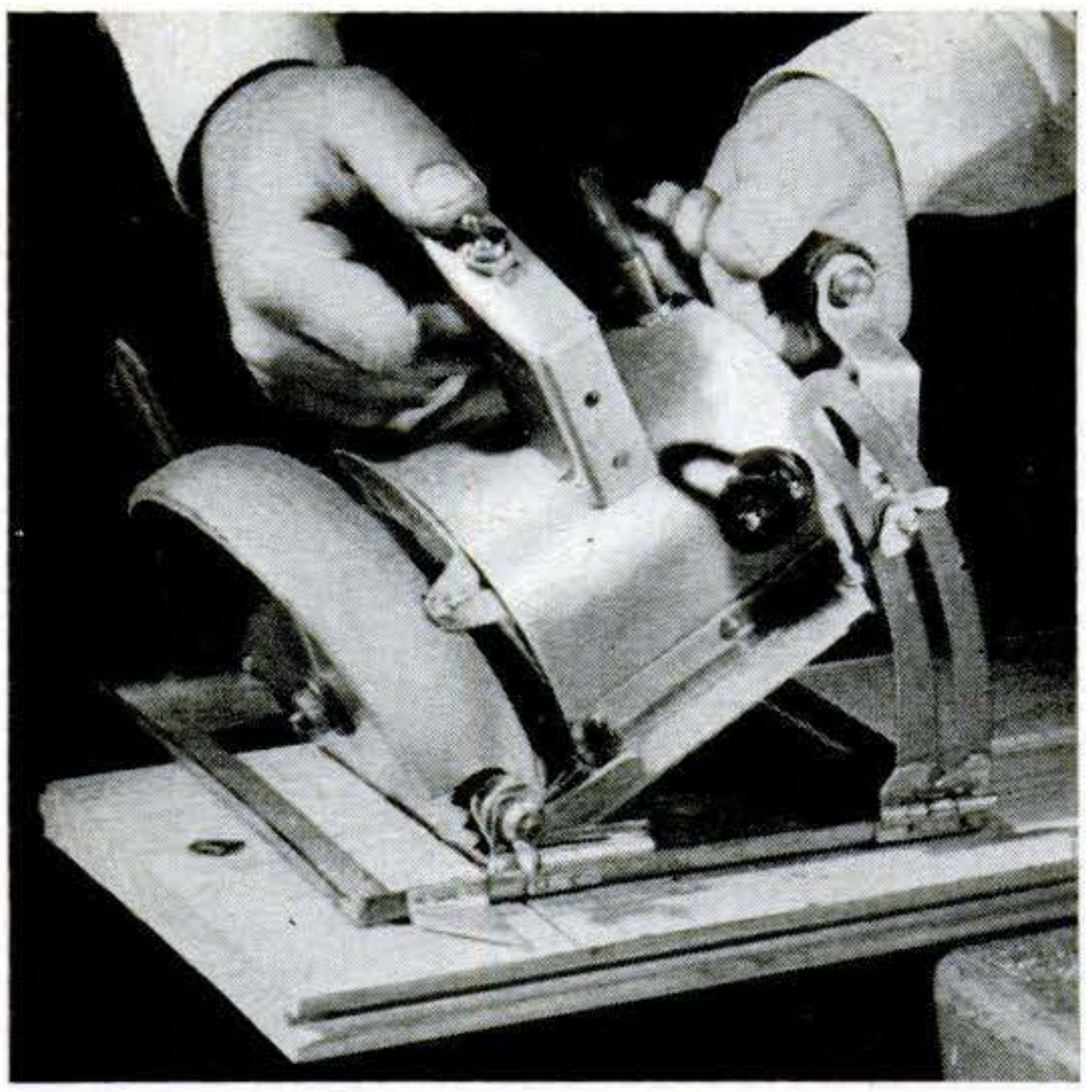
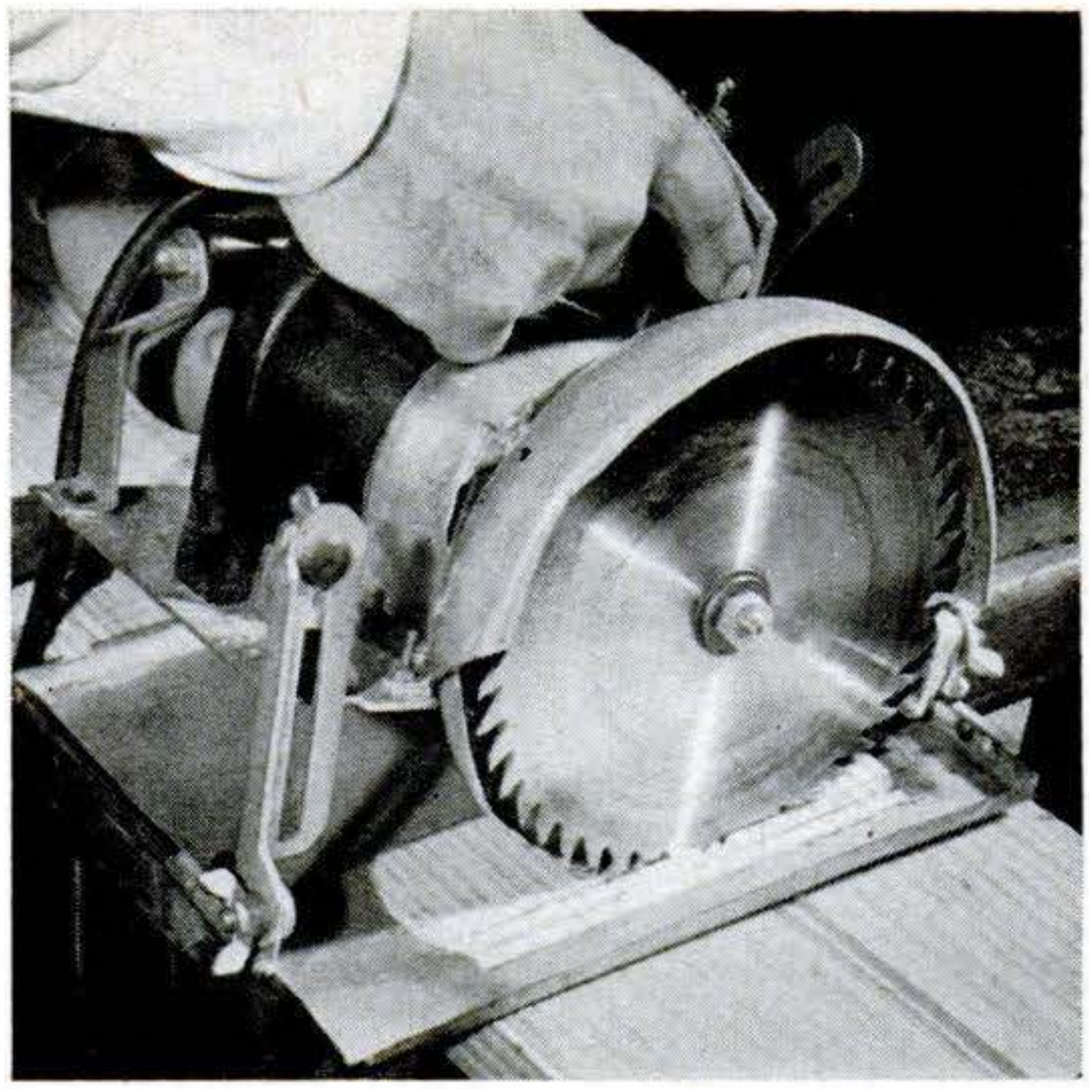


ANGLE CUTS are made by tilting the base plate and locking wing nut on the quadrant. Pointer is not accurate when motor is tilted. You can follow progress of saw cut by eye, or use fence when accuracy is important.



DADOES are cut with rear of base plate raised and locked to give desired depth of cut. Successive passes between layout lines cut away the stock. Base plate pivots on front hinge and quadrant's hinge.

plate brackets to align with those they join. Use square-shouldered carriage bolts and wing nuts for convenient adjustment.

Guards and housing. Cut the stationary saw guard from the removable end section of the vacuum tank and mount it on the bent-over ears on the front motor flange. Rivet two angles on the bottom edge to attach the guard to the base.

The rotating guard is made of 16-gauge dural hammered into shape. Join it to the stationary guard by slipping it on the collar of the latter and peening the collar over lightly. Fit a tension spring to keep the rotating guard over the blade.

Bend up a motor housing, also of 16-gauge dural, to fit closely over the motor, and cut 1″ holes on each side to clear the brushes and give access to them. Rivet the housing to the base plate with flush rivets.

Handles. Cut the center handle from a glued double thickness of ⅝″ plywood and install a toggle switch in the top, well forward yet within reach of the thumb.

Wiring. Bring the line cord into the housing through an insulated bushing. Run one lead directly to the motor, the other through the handle to the toggle switch and then to the motor. Attach a .01-mfd. condenser to the lower part of the handle and solder the leads to the brush terminals to minimize arcing over the commutator.

Mounting the blade. In the saw shown, the impeller hub of the cleaner has a ½″ shoulder just right for the blade. The nut, with a washer under it, secured both hub and blade to the motor shaft.

If you can't use the impeller hub this way, you may have to buy or turn an adapter collar to bush down the hole in the saw. If you don't have a lathe, you might shoulder a piece of brass in a drill press.

A right-hand shaft nut can be secured with a lock washer. If the nut is a left-hand one and shows any tendency to loosen, you may have to sacrifice easy interchangeability of blades and lock it by punch dots between the nut and the shaft or washer.

Tips on operation. For crosscutting, use the pointed guide to follow a pencil line. Keep the feed constant and don't let the saw dwell in one spot. For longer cuts or ripping, clamp a strip of wood to the work as a fence. Make inside cuts by resting the forward edge of the shoe on the work and lowering the saw into it.

Use a heavy-duty extension cord, with at least No. 14 wire, when you are working more than 50′ from an outlet so that the saw will receive full line voltage. Use nail-cutting blades and abrasive cut-off wheels 1″ smaller than the diameter of the regular saw blade, as these require more driving power. Vacuum-cleaner motors can wind up to more than 8,500 r.p.m. without load, so check the recommended operating speed of any abrasive wheel you buy.—*Richard Lieto, Cliffside Park, N. J.*

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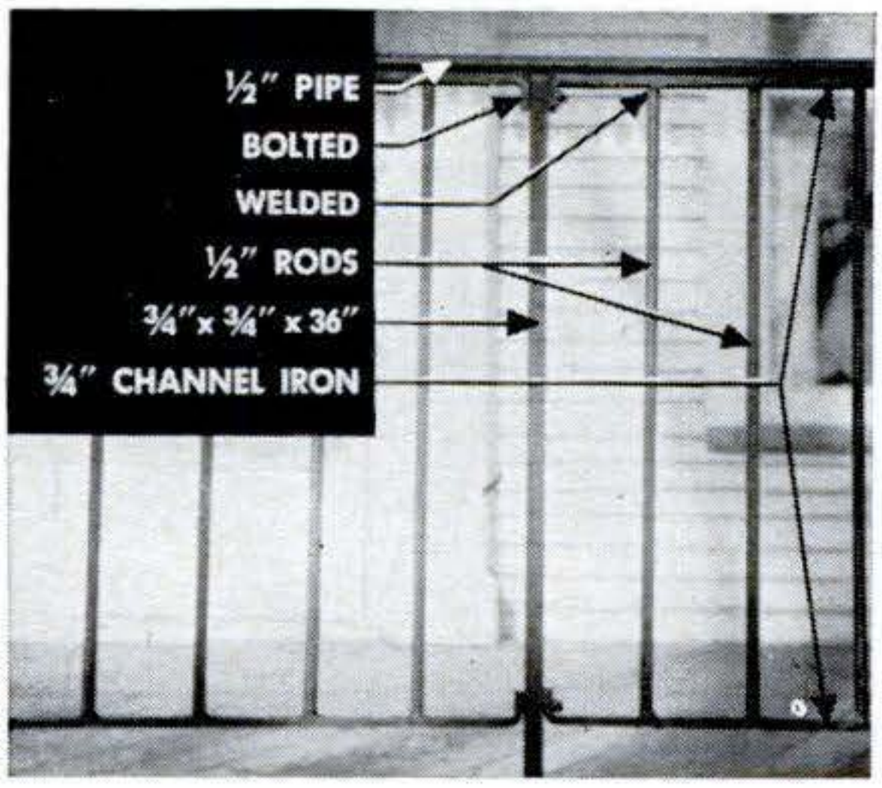
Low-Cost Porch Railing Uses Reinforcing Rods



THIS handsome iron porch railing cost me only $28. That's about $1 a running foot. The best price I could get for a similar commercial railing was $5 a foot.

Building it was easy. Here's what you would need to duplicate it: ¾"-square iron posts 36" long, ¾" channel iron, ½" reinforcing rods (the kind used in reinforced concrete), ½" iron pipe.

Mark off the locations of the posts, spacing them evenly. Hacksaw the channel iron to fit between posts with a couple of inches to spare. Heat the ends of the channel-iron lengths and bend them down 1". Hacksaw the reinforcing rods into 26" pieces. Lay the pieces between lengths of the channel iron, spacing them 4" apart, and weld the rods to the channel iron.

I built a wooden frame to hold two pieces of channel iron and the rods. I then had a shop do all the welding at a cost of $12.

Drill holes through the bent ends of the channel-iron lengths and drill matching holes in the posts. Then you can bolt the railing sections to the posts.

Chisel or drill holes in the concrete 6" deep. Set the posts in the holes, square them carefully, and pour molten lead in the holes around the ends of the posts.

Bolt the ½" pipe to the top rail and paint the railing black.—*Charles A. Towne, Des Moines.*

Movie Leaders from Old Film

BLANK film for use as leaders at the beginning and end of home movies can be made from a length of discarded film. Soak it for half an hour or so in water. Then scrape off the emulsion with a dull knife.—*Ernest Herzog, Bethlehem, Pa.*

Workshop Wisdom

At his lathe a neat chap name of Fry
Had insisted on wearing his tie.
Soon an excess of torque
Wrapped him up in his work
With an impulse he could not deny.

Mailbox Mounted on Old Plow

M. A. LAMMERT of Versailles, Mo., made this unusual mailbox mount from an old wooden-beam walking plow. The wooden parts were given a coat of red paint and the metal parts were finished with aluminum paint.—*L. H. Houck, Jefferson City, Mo.*

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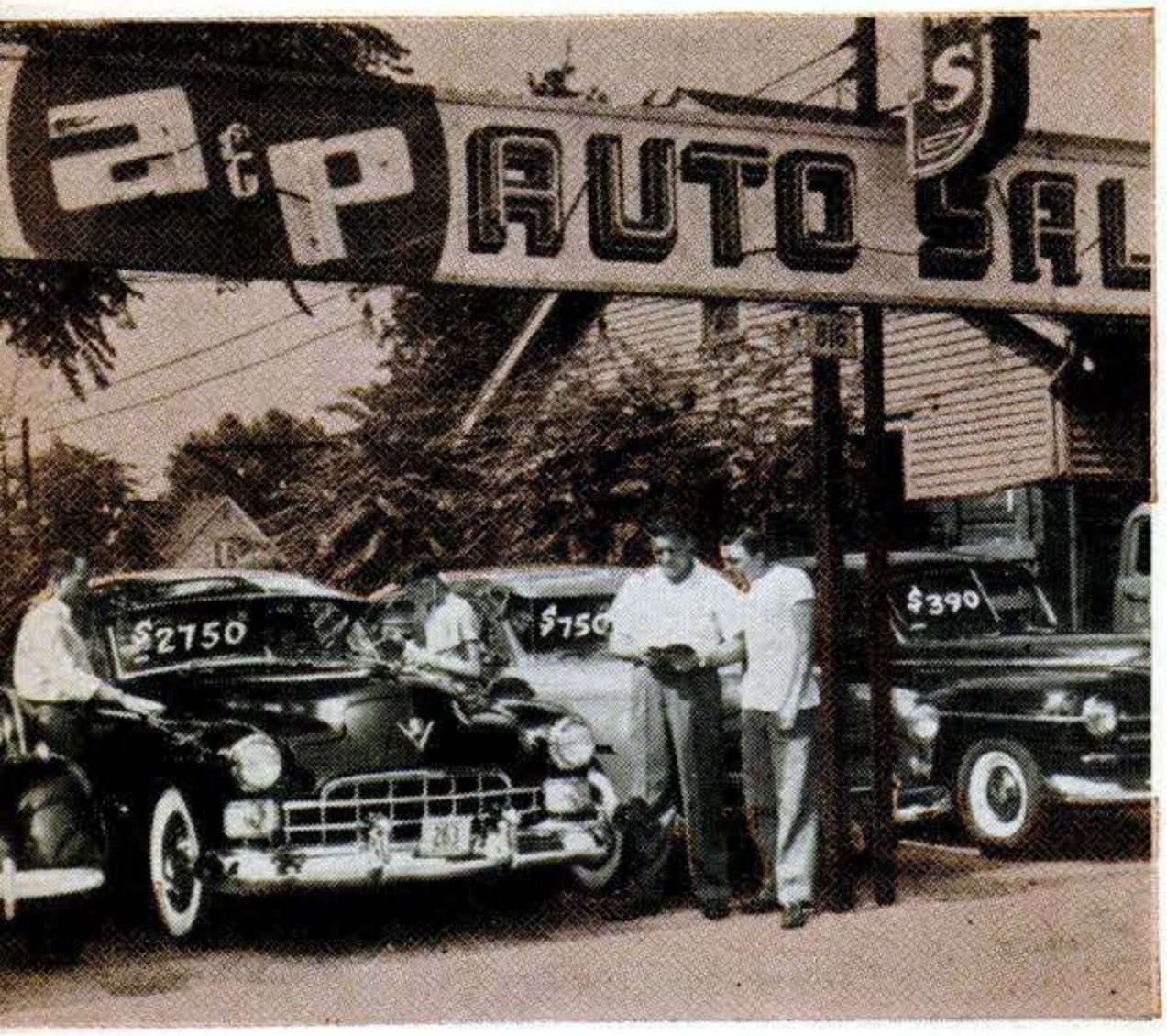
Tips for



Even an auto that looks good may have one wheel in the graveyard. Here's how to avoid a rubber-tired headache.

Discount prejudices against particular makes when you start shopping for a used car. Mechanical condition rather than make should be your buying guide.

A new-car dealer often has the best buys. He can afford to put lower price tags on his trade-ins. If he has a service department, your chances are better that defects have been repaired. If the original owner was a regular customer, the dealer may be able to show you his repair files on a particular car.

Check your own car, as a would-be buyer, before looking at another. You know its weaknesses. If you didn't, could you spot them? This practice will give you more confidence when you start checking a strange car.

Steer clear of '46 models as a rule. The first new cars after the war, these were often poorly assembled. If you have doubts about the age of a car, check the serial number against the list in the dealer's Red Book. This will show the year.

Avoid big crates. It's often wiser to buy a small- or medium-sized car than to pay an equal amount for a large one that is older. Operating costs and repairs for higher-priced cars usually are higher.

ENGINE

A vacuum gauge will tip you off to a variety of engine troubles—bad piston rings, a clogged exhaust system, weak valve springs, incorrect timing, worn valve guides and burned or sticking valves. The money you are likely to save in one used-car deal justifies buying a gauge and learning how to use it.

Watch the exhaust while the engine is revved up half a dozen times. Clouds of blue smoke out the tailpipe mean a costly ring job will be required to cut down heavy oil consumption.

Worn or loose bearings are something you don't want. Traveling at about 15 m.p.h. in high gear, gradually step down on both the foot brake and accelerator, using the brake to maintain an even speed until the accelerator has reached the floor. You will hear thumps from the main bearings, hollow knocks from the con-rod bearings. The knocks will be low, even and regular if the bearings are okay.

Keep an eye on the heat gauge while you are road-testing the car. If the engine overheats, you might be letting yourself in for expensive cooling-system repairs.

Accelerate quickly while traveling about 10 m.p.h. in high. If the car picks up rapidly and smoothly without sputtering, better take it—if everything else meets your requirements.

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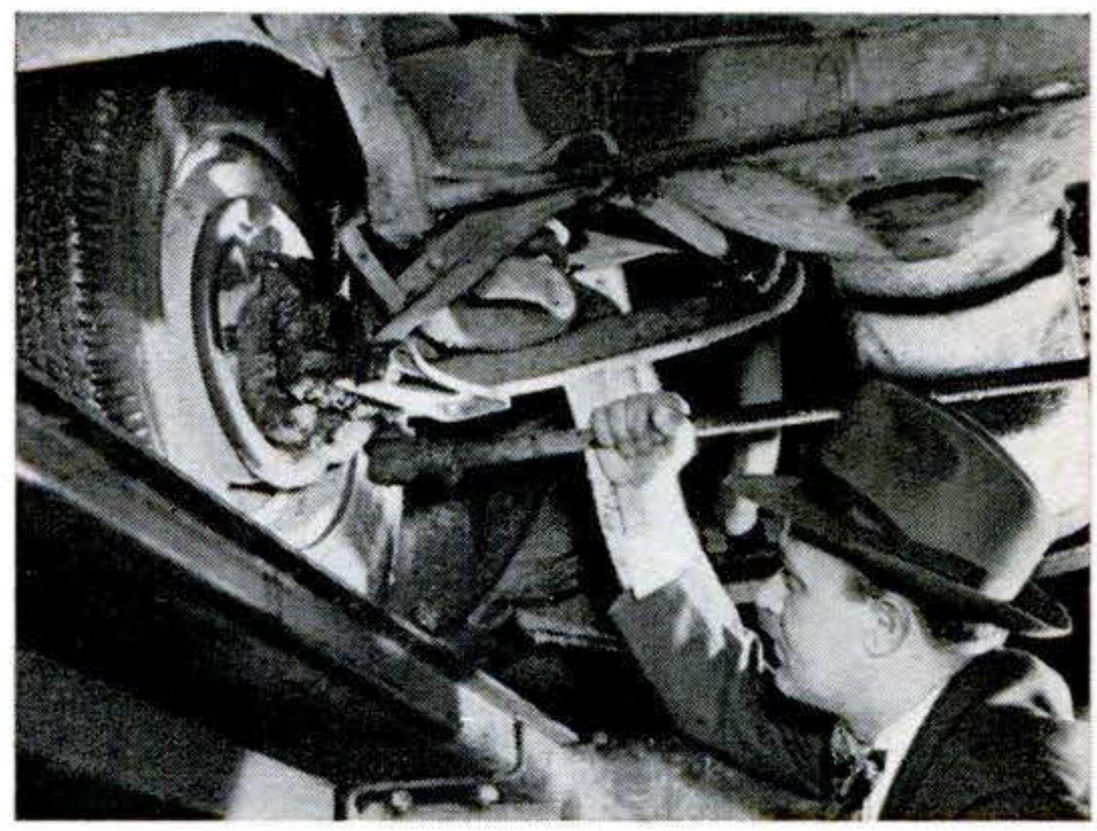
Used-Car Buyers



BODY

Scrape off a little paint from the edge of the body metal, or lift up windshield molding, to see if you can find paint of a different color. A new paint job on a recent model may mean the car is a worn-out taxi.

Inside the car, bounce on the seats to see if you can find signs of broken springs. Take a look under the seat covers if the car has them. Badly worn upholstery in a recent model is another taxi sign.

Prod the body metal at fender joints and along the bottom edge of doors with a pencil. This may show up metal that is almost rusted through. Body work is expensive.

Try all the doors. If they stick or must be slammed, the car frame may have been twisted in a wreck. Obviously new parts also are a tip-off to a wreck. Look too for welding or heat marks on the frame, a sign that it has been straightened.

Dents and scratches, besides detracting from the appearance of the car, suggest hard usage by someone who wasn't particular about maintenance or driving carefully. Better check very thoroughly.

Worn pedal pads or floor mats may indicate a high mileage that doesn't show on the speedometer. Obviously new pads and mats likewise suggest an attempt to cover up hard usage of the car.

RUNNING GEAR

Front-end inspection should always be very thorough. Get the car on a lift if you have the chance. Try the steering linkage for looseness. Look over springs and suspension parts. Examine tires, including inner sidewalls. Spotty tread wear means wheels are or have been out of alignment.

If the front wheels shimmy on a rough road or if they bind when you make a sharp turn in either direction, the car is a very poor bet. If the car always veers to the same side when you take your hands from the wheel on a level road, the front end is probably out of line.

More than two inches of play in the steering wheel indicates the car is not safe to drive.

Test the clutch for slippage by setting the hand brake, shifting into second, speeding up the engine to a fast idle and slowly letting out the clutch. The engine should stall promptly if the clutch is okay.

Hold down the brake pedal for at least half a minute. If the pedal sinks, the hydraulic pistons are letting fluid pass.

Howling or grinding noises from the transmission when you speed up quickly to 20 m.p.h. in low gear are a tip-off to badly worn gears. A hum from the rear end means you'll have to pour some dollars into the differential.

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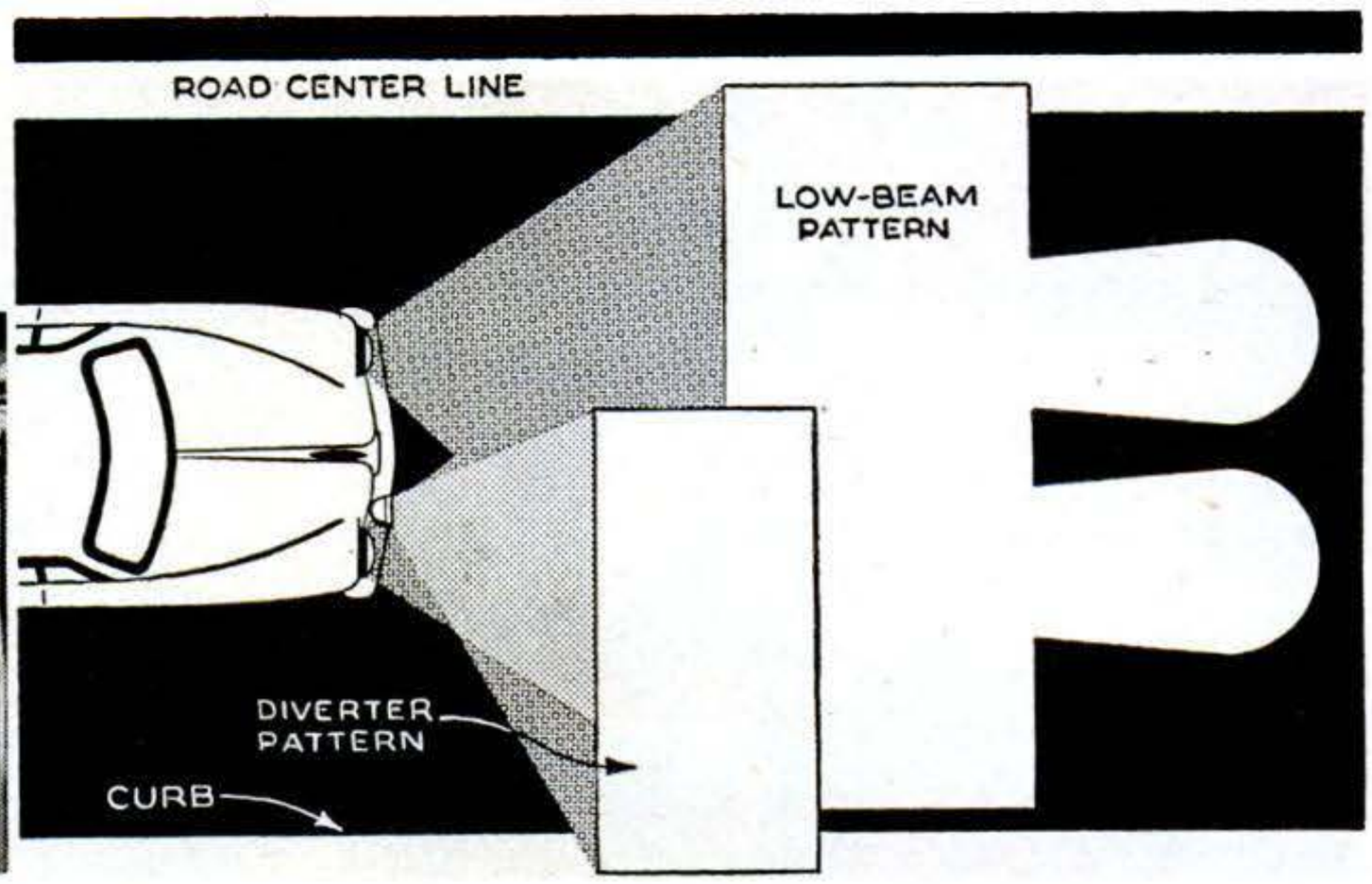
3 New Items for Motorists

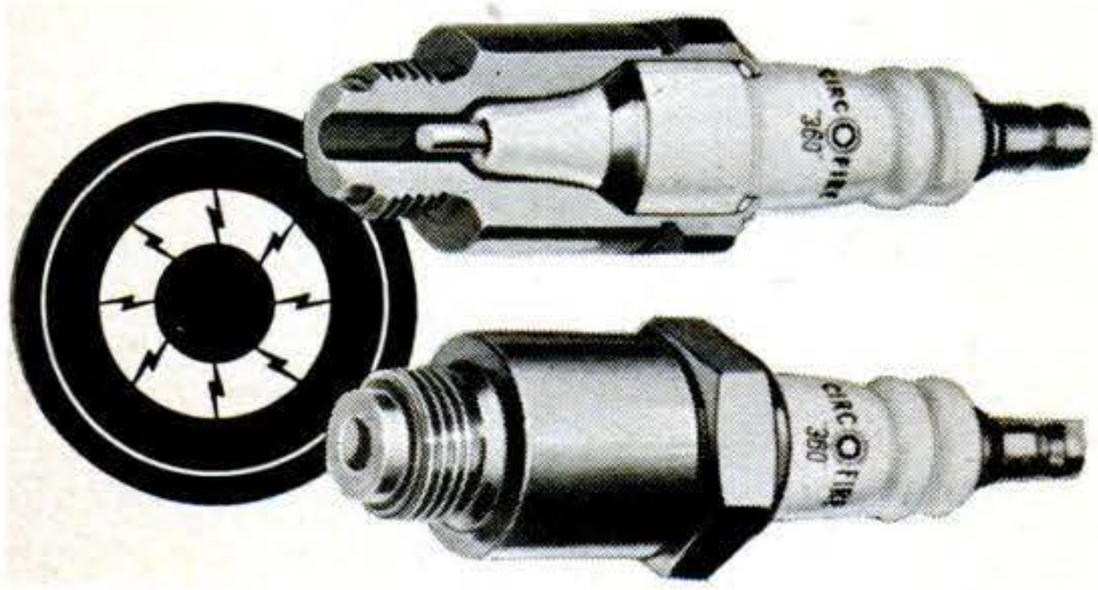


Extra Driving Light Helps Motorist Combat Night Blindness

FIXING your eyes on the right edge of the road has long been recommended for night driving—that way oncoming headlights don't blind you. A new accessory light helps you do this.

This "diverter" lighting system, patented by Charles Adler Jr. of Baltimore, throws a bright patch of light along the curbing immediately ahead of the car. More intense than the low-beam pattern, upon which it is partly superimposed, the bright patch is intended to divert your eyes automatically from approaching headlamps. After a series of tests, Maryland authorities found that the diverter apparently does not disturb other drivers.

The diverter light is wired to go on simultaneously with the low beams. A switch turns it off in cities and other brightly lighted areas. The photo shows the low, right-hand mounting of the diverter, whose intensity is being tested with a light meter. The lamps are distributed by Martin J. Barry, Baltimore.

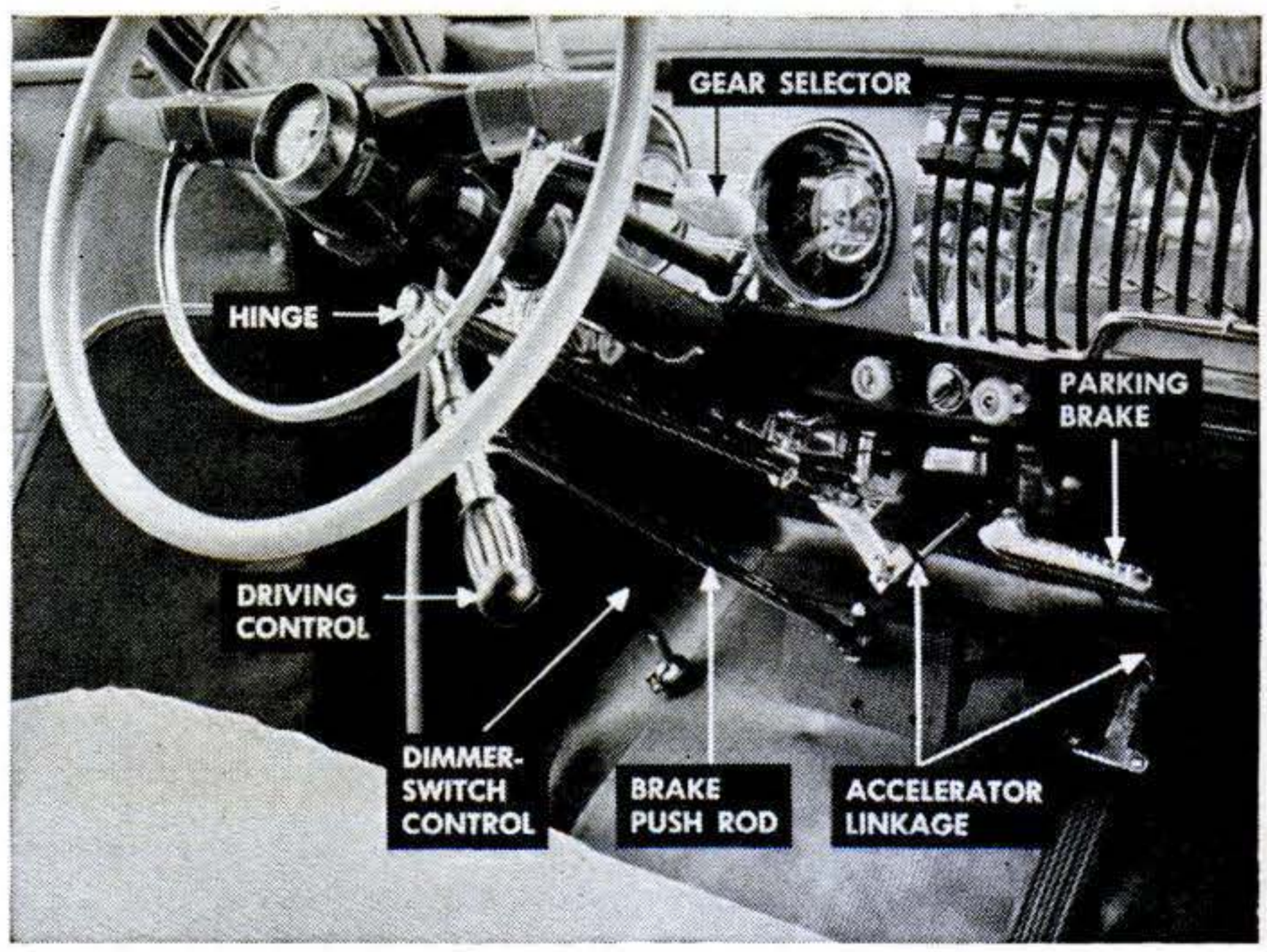


Plug Fires Circular Spark

A NEW spark plug fires in a full circle around a center electrode, the spark jumping to the inside wall of the metal shell instead of between two points. The maker, Circ-O-Fire Spark Plug Co., Detroit, points out that the plug never requires regapping because the setting is permanent, and says it seldom needs cleaning.

New Car Control Aids Amputees

CAR brakes and accelerator can be operated by hand with a new driving control designed for amputees and others who have leg handicaps. Pushing the handle applies the brakes. Pulling it toward the seat depresses the accelerator. A hand rod also works the dimmer switch. Developed by Raymond K. Wilson of Louisville, Ky., the control will be available for all cars with automatic transmission.



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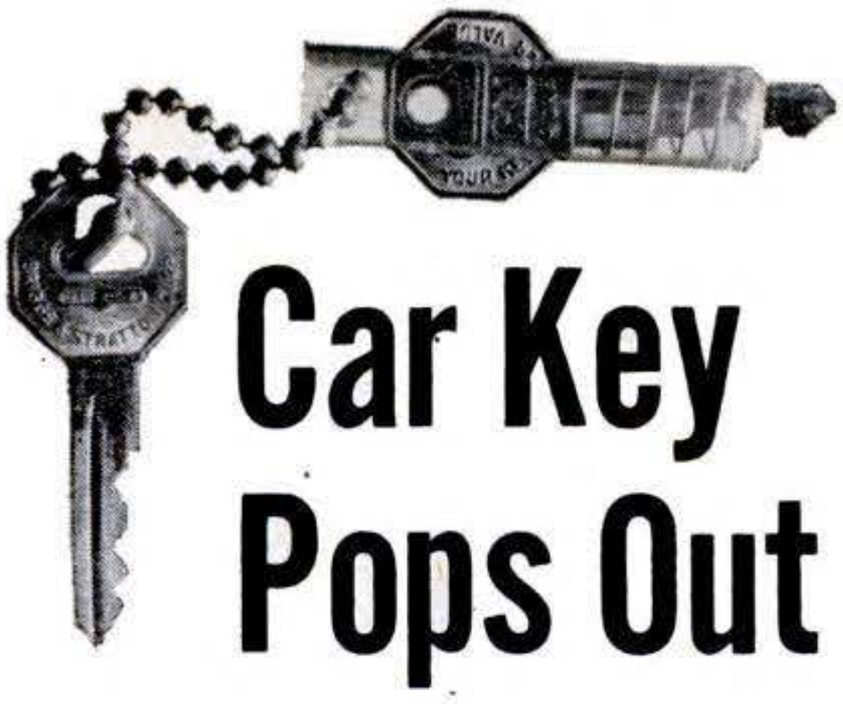
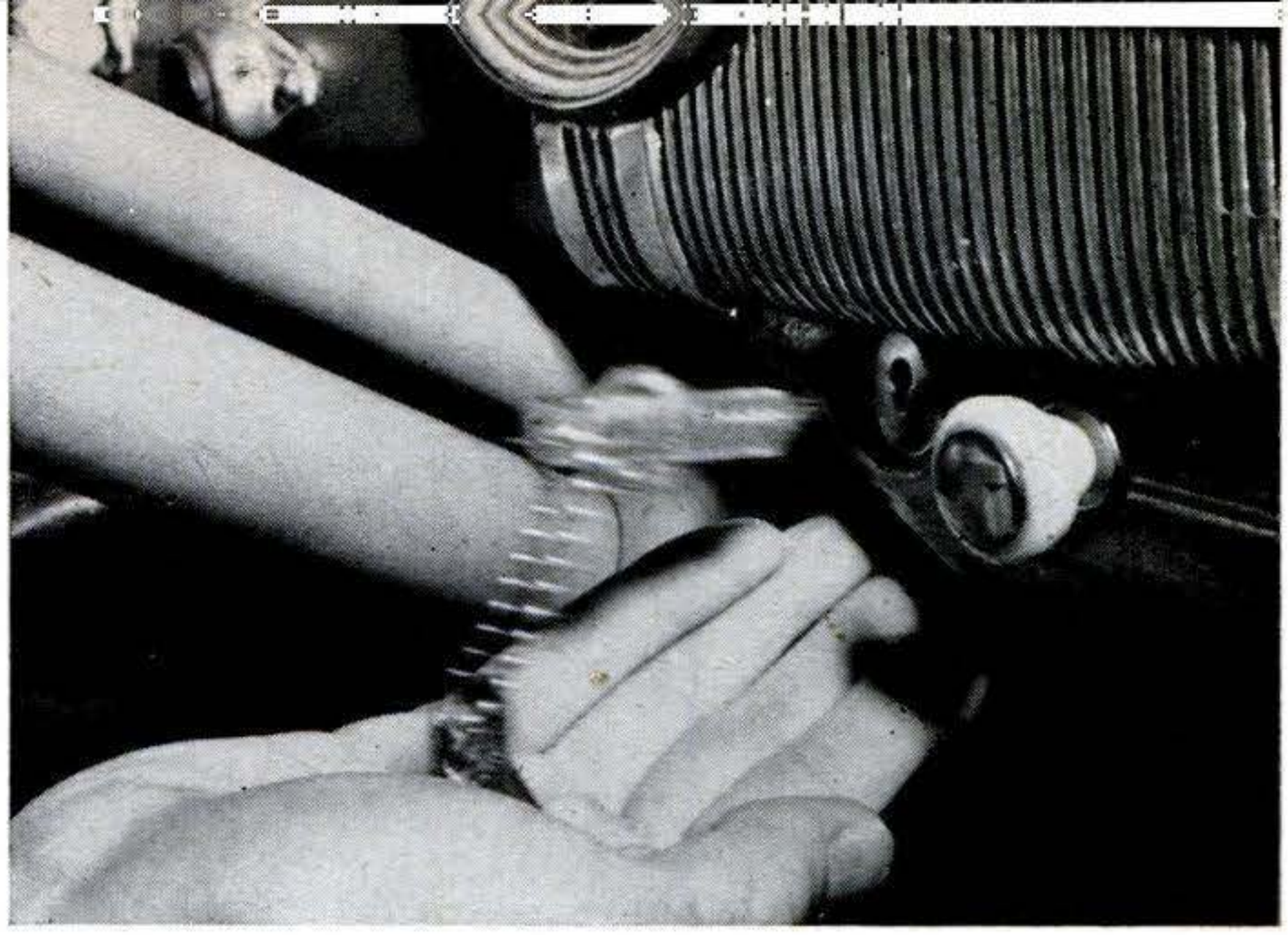


Car Key Pops Out

Homemade spring ejector tosses it into your hand when you turn off ignition.



LEAVING the ignition key in your car invites theft—and may lock you out. But this ejector won't let you forget. It pops the key out into your hand when you switch off the ignition.

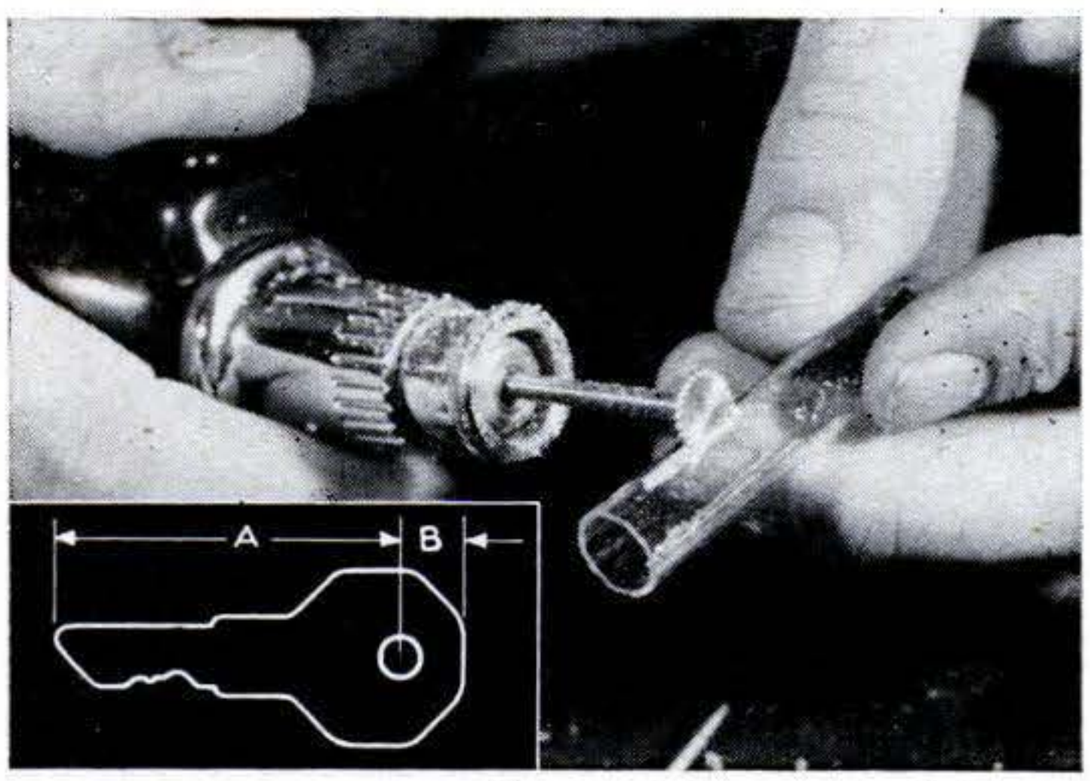
The ejector can be made from plastic tubing having an inside diameter 1/16″ larger than the width of the key blade. The length can vary, but it should be about 2″.

Starting ¼″ from the end of the tube, cut two longitudinal slots, one directly opposite the other. A hand grinder is ideal for this, but a knife with a good point can be used. Make the slots wide enough so the key will not bind. Smooth the edges.

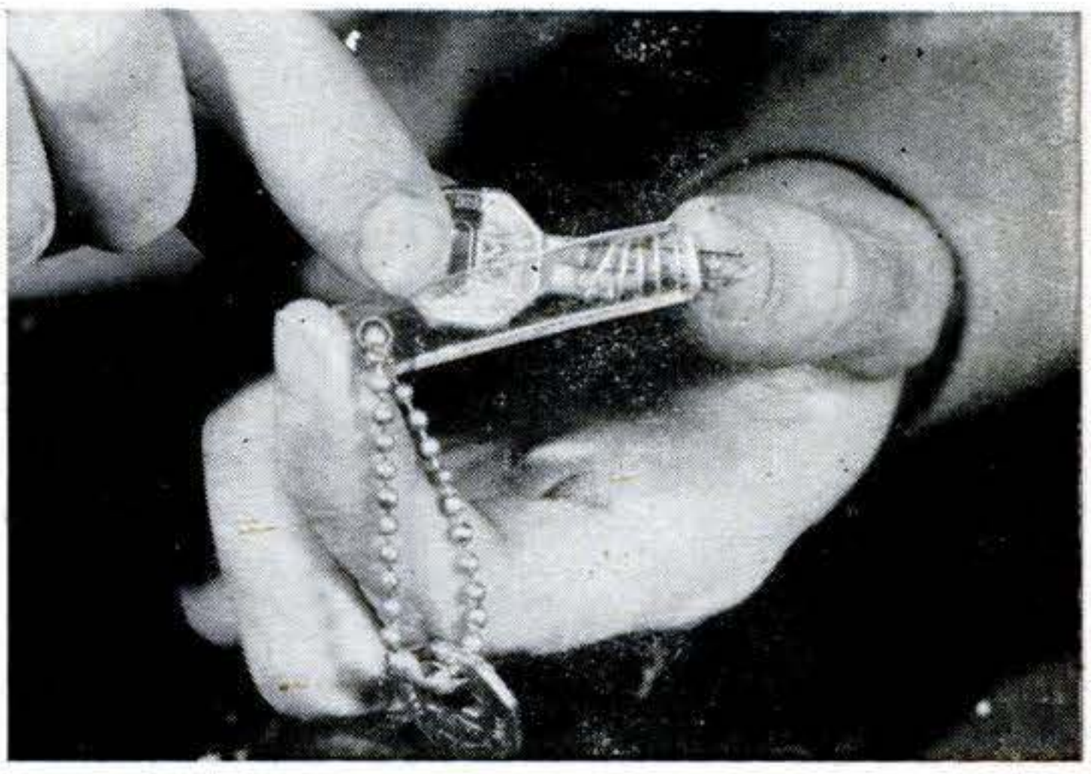
Using a drill slightly larger than the tubing, countersink a blind hole in a piece of scrap wood. Heat the end of the tube in hot water and press it into the wood hole with a twisting motion. Repeat until the tube is crimped enough to keep a compression spring from falling through.

Assemble the ejector by inserting the spring, compressing it, and then sliding in the key. Put a key chain into a hole drilled through the tubing near the back end.

When you put the key into the ignition, you automatically compress the spring. With the ignition on the key stays in.—*John Capotosto, New York City.*



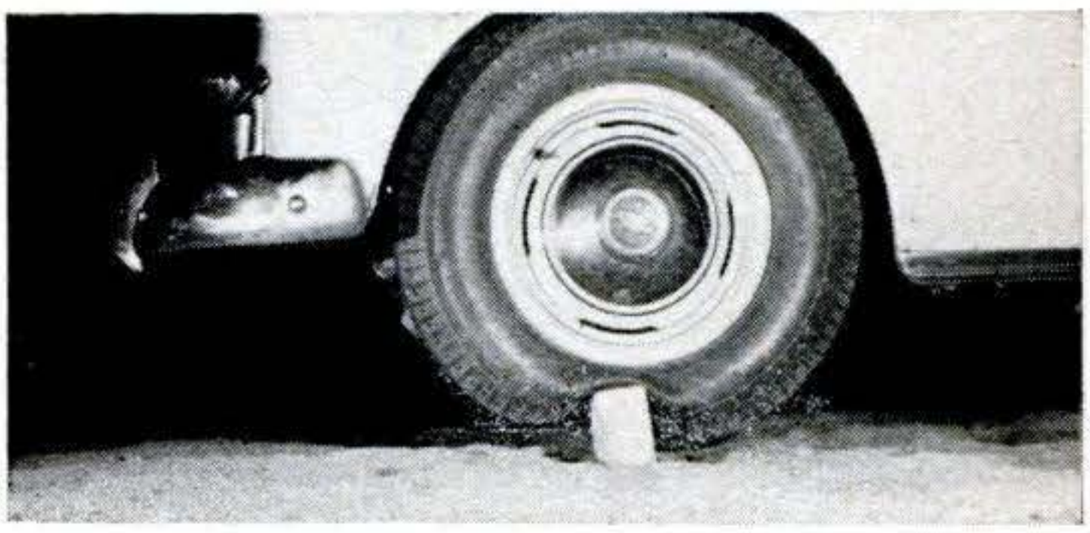
A HAND GRINDER makes quick work of forming slots in plastic tubing. Dimension A of key determines slot length. At distance B from end of slot, drill hole for key chain.



INSERT KEY through short compression spring. End of plastic tube must be crimped to retain spring. If the spring you have is too long, cut it to about six turns.

Speed Flash Shows Tire Damage

IF YOU drive over a brick at 40 miles an hour, this is what happens to the tire—even if it is properly inflated. Seiberling Rubber Co. took the photo at 1/15,000 second while studying the effects of road obstacles on tires. Such severe blows may break the tire fabric.



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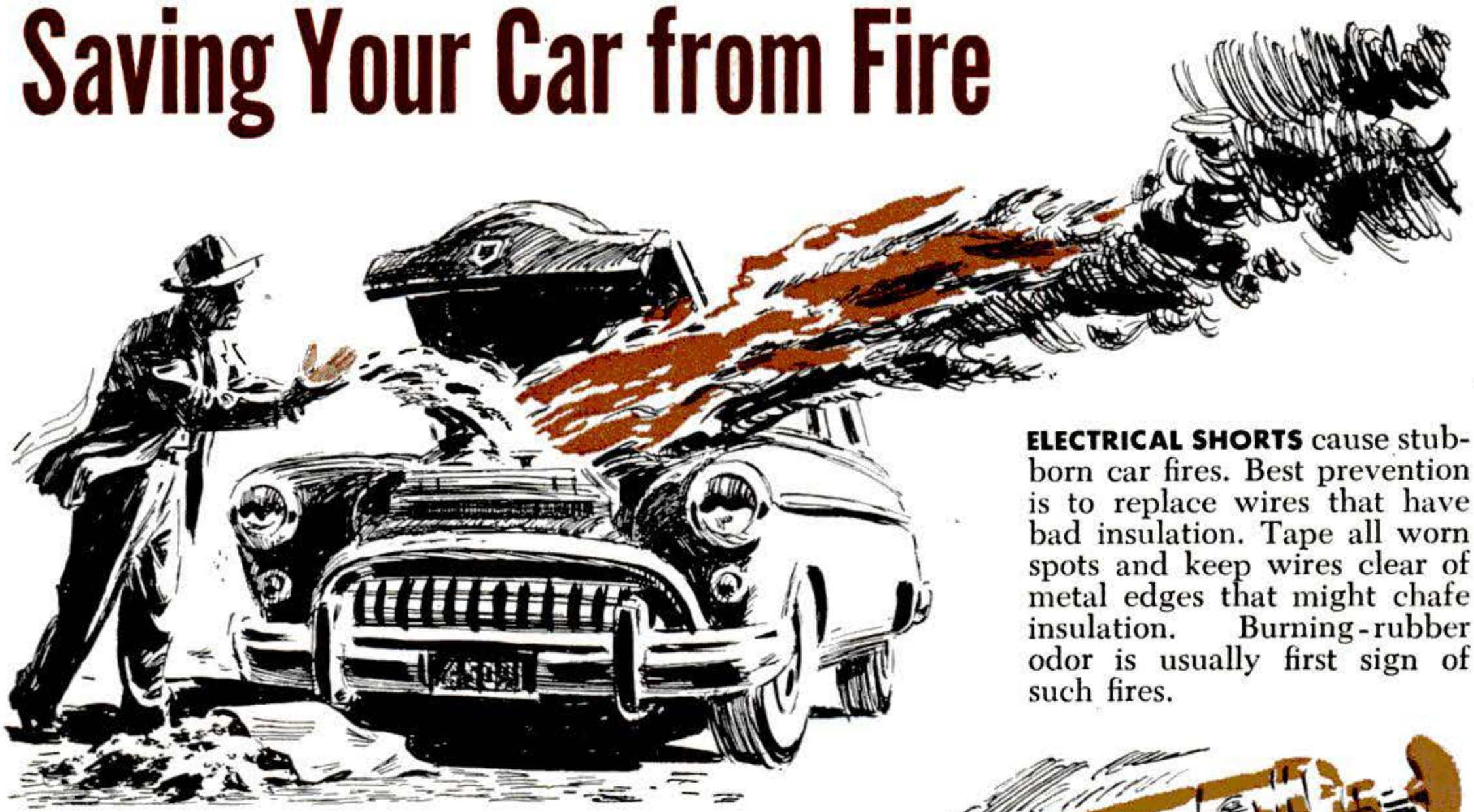
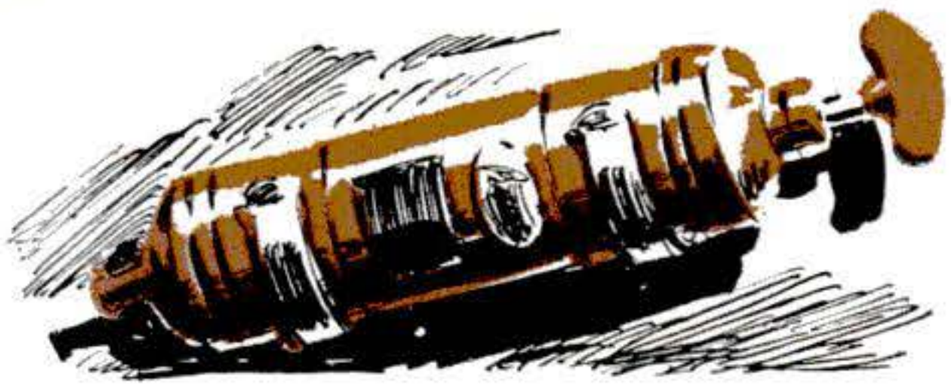
Saving Your Car from Fire

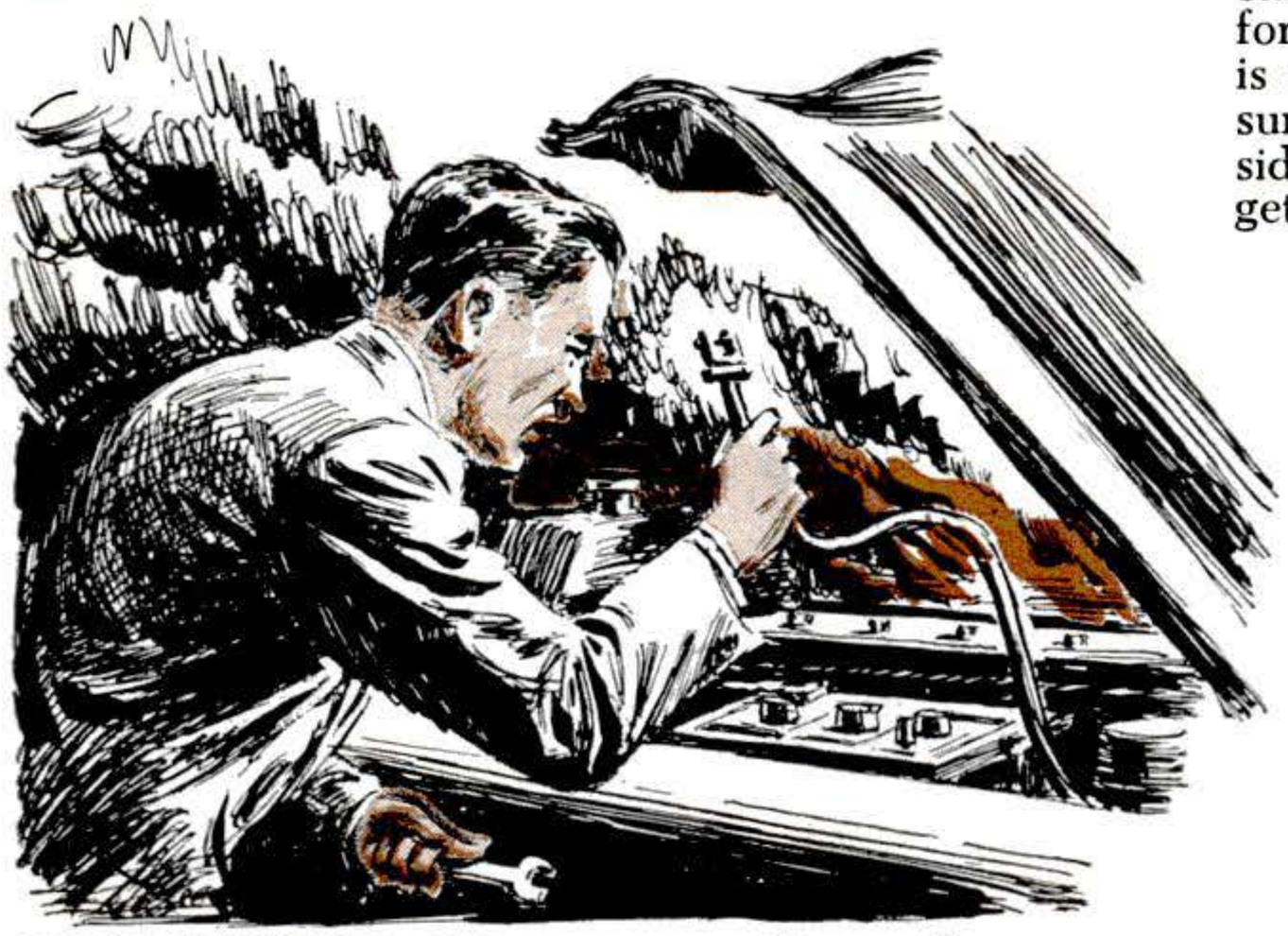


ELECTRICAL SHORTS cause stubborn car fires. Best prevention is to replace wires that have bad insulation. Tape all worn spots and keep wires clear of metal edges that might chafe insulation. Burning-rubber odor is usually first sign of such fires.

BAG OF SAND in trunk is cheap protection against gasoline-fed fires. (In winter, you can also use it for traction on ice.) Roadside dirt is better than nothing. Have extinguisher or sand ready before lifting hood because additional air let in may cause fire to burn more fiercely.



SMALL EXTINGUISHER is good insurance for any car owner. Handy spot to carry it is in a bracket on front side wall. Pressure-type container shouldn't be kept inside glove compartment or trunk; it may get too hot in summer and give way.



HEAVIER FUSES than those recommended, or bridging a fuse with a jumper, are dangerous. Electrical accessories added to a car should always be fused. A blown fuse, or circuit breaker that keeps opening, signals trouble that should be tracked down.

WHEN ELECTRICAL FIRE occurs on the road, turn off all switches and, if possible, remove one of the cables from battery to cut current from all car wiring (above). Before storing car, even for a few days, it's also a good idea to lift cable from battery post. This is particularly important on an older car, since wiring harness may have deteriorated. Fires have occurred in stored cars from shorts caused by ground vibration or minor garage bumps.

BURNING UPHOLSTERY is tough to put out. Drag loose seats out of the car and rip apart attached cushions to get at fire. Always inspect car for cigarettes before leaving it. Upholstery fires in hard-top cars can sometimes be smothered by shutting all windows, doors, vents.

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Whitewalls for $1

One pint of special paint will convert four ordinary tires into the fancy kind.

ALTHOUGH the Government has forbidden manufacture of rubber whitewalls, you still can have a perfectly legal and good-looking set for less than a dollar. You do it with paint.

Mail-order and auto-supply stores sell white paint made for the purpose. A pint does four tires, with some over to start the spare.

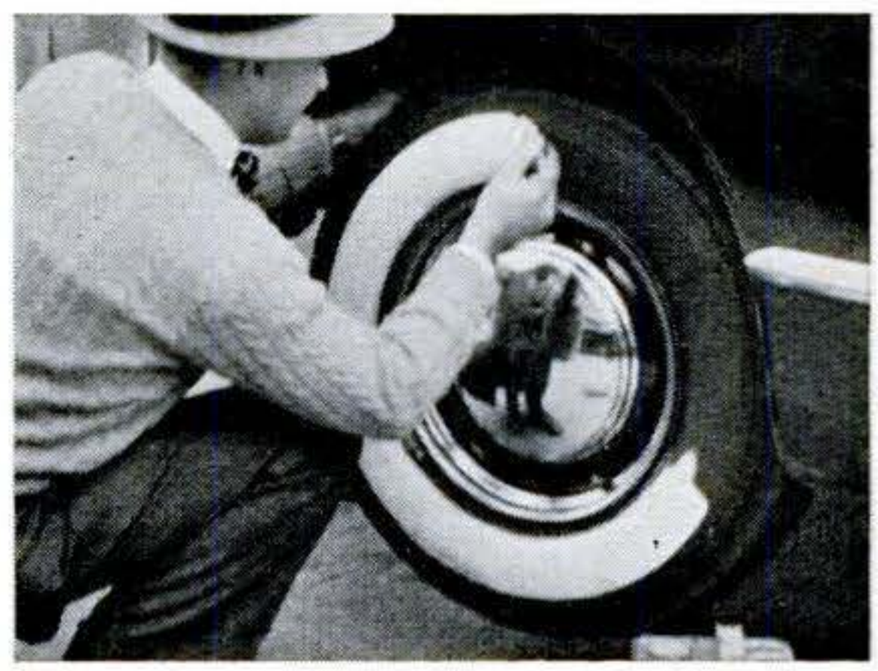
Two coats are enough, although a third put on about six months later will add durability and permit an occasional bump against the curb without scuffing through to the black. Soap and water take off dirt.

An older tire will look better if remounted on the rim with the scuffed side in, so as to present an unmarked outside wall for the paint. The manufacturer's lettering will then stand out like new.

It is important never to brush this paint. For a smooth result, just flow it on.

The paint can also be used to refurbish real whitewalls. And if you need replacements to match some already on the car, regular black tires and a can of paint will do the trick.

1 PREPARE TIRE by swabbing side with gasoline. Jack up wheel and release brake so the wheel can be turned. Chock other wheels for safety. No masking is needed.



2 ROTATE WHEEL as you paint so work is always done at the top. Flow paint into the rim joint; follow scuff bead for outer guide. First coat looks streaky, may turn yellow.

3 FLOW ON second coat and paint will smooth out by itself. Paint dries so fast that you don't have to wait to apply second coat—just keep working around.

Regraining a Dashboard

To FIX up the badly marred instrument panel on my old car, I mixed black enamel with aluminum paint and brushed it on. After the paint dried, I rubbed the panel lightly with auto compound and then waxed it. The result was a gray finish with nice grain.—*H. E. Lunde, Oswego, N.Y.*

Wiper Blade Cleans Windows

AFTER washing your car, lift off one of the wiper blades and use it as a squeegee to wipe down the wet windows and windshield. They then will dry free of spots. To unhook the blade, pull the wiper arm straight out from the windshield a couple of inches.—*C. A. Kleppe, Milwaukee.*

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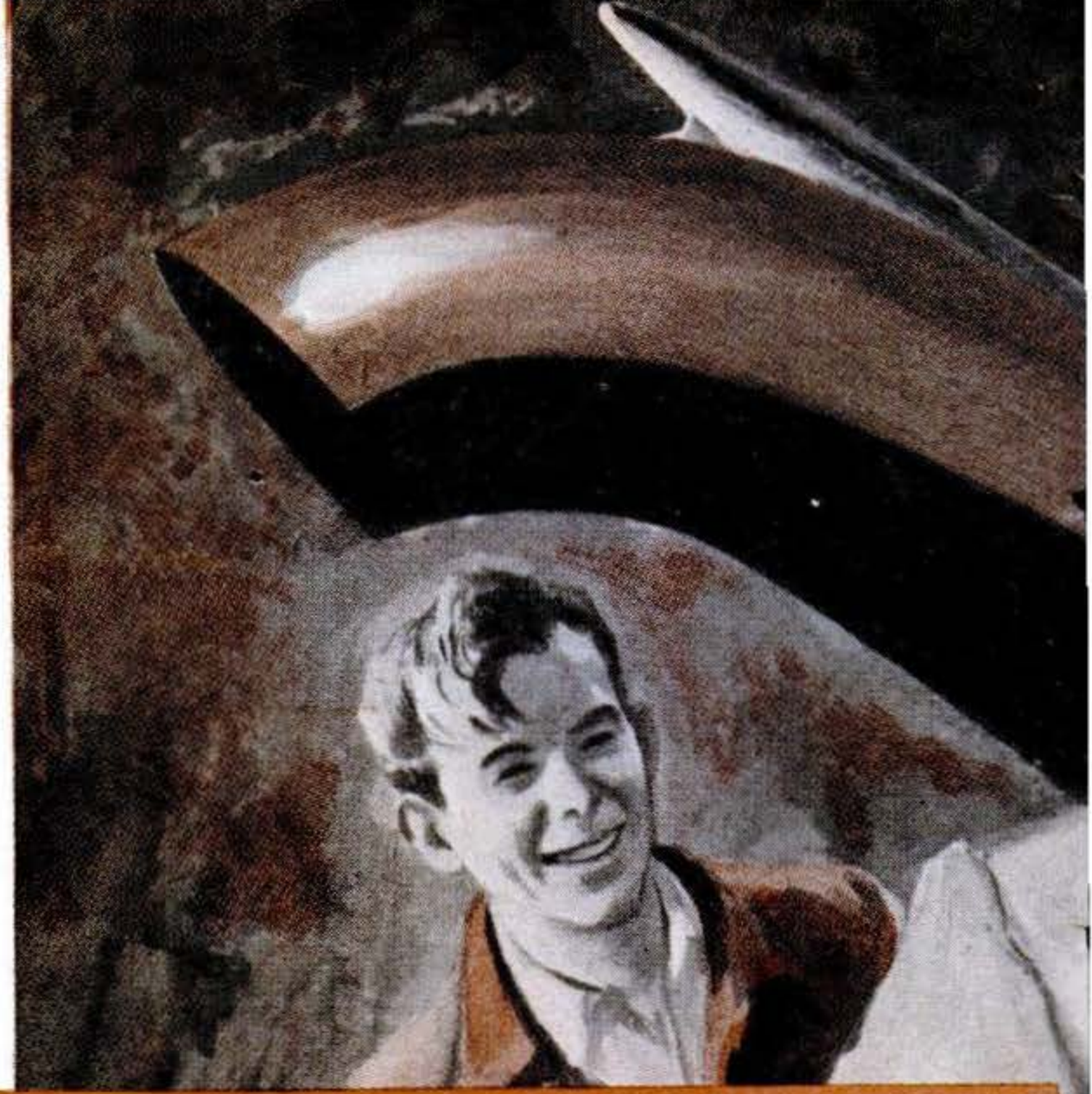
By Martin Bunn



Gus Bets on a Long Shot

Those rumors about a de luxe service station opening right next to the Model Garage didn't worry Gus much—only $500 worth!

GUS WILSON had never worried too much about competition. Most of the people in town just naturally brought their cars to the Model Garage when they needed repairs. So Gus and Stan Hicks, his helper, ordinarily had more work than they could comfortably handle.

Then, one morning not long ago, something happened that set Gus to thinking. He had arrived at the garage a little earlier than usual and was working on a tune-up job when Stan Hicks came hurrying in, all out of breath.

"Gosh, Gus," Stan said excitedly, "have you heard the rumor?"

"Lots of them. What's the latest?"

"Gee, I sorta hate to tell you. But I had breakfast at Dan's place this morning and he told me something I guess you oughta know."

"What's that?"

"Well, Dan says two strangers came into his place for dinner last night and he heard them talking about garages. They looked like a couple of businessmen from the city and they were discussing some sort of a deal to buy that land down here on the corner for a big new service station. You know, one of those super, glamor jobs with all kinds of equipment and a flock of attendants in white coveralls. It sure could be tough on us."

"Probably just a rumor," Gus said and turned back to his test panel.

Gus Spends a Sleepless Night

But if Gus thought that his nonchalance had fooled Stan, he was wrong. And if he thought he was successfully kidding himself, he was wrong again. The rest of that day and most of the night, Gus thought a good deal about what might happen if some big service station and garage did move in practically next door. Sure, he told himself, a lot of the townspeople would continue to patronize the Model Garage, but he also knew that a flashy front and high-pressure selling have put more than one small outfit out of business.

He was still worrying about it when he showed up at the garage the next morning.

"Hi, Gus," Stan greeted him. "Some guy in a convertible stopped by about 15 minutes ago. Had a bad engine miss, but

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wouldn't leave his car. Said he didn't want anyone but you to touch it. He'll be back."

"Someone we know?"

"Never saw him before. But he said he'd heard about you."

Gus felt a little better after hearing that. Maybe the Model Garage's good reputation would be insurance against any competition that might come into the neighborhood. He was just about to go to work when he heard a car pull up outside.

"Here's that guy with the convertible," called Stan.

Gus walked toward the parked car. "Something I can do for you?" he asked the man behind the wheel.

"You sure can if you're Gus Wilson."

"Well, that's me."

"Mighty glad to know you, Mr. Wilson. My name's Kell, Stanley T. Kell. From all I hear you're quite a guy when it comes to fixing cars."

"Thanks, Mr. Kell," grinned Gus. "What seems to be ailing yours?"

"Well, every once in a while she begins missing a beat. Runs fine one day and acts up the next. Right now, she's acting up. Here, listen." Kell pushed down slowly on

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the gas pedal. There was little doubt that the engine wasn't perking on all cylinders.

"I've had it to a half-dozen places. Fakers, all of 'em," Kell grumbled. "They've practically rebuilt the engine and the miss still comes back."

Gus listened to the engine for a few moments. "Okay. Drive her inside and we'll see what we can find."

Stranger Rubs Gus the Wrong Way

Kell was a short, wiry man, nattily dressed in expensive clothes. His whole manner exuded self-confidence. "Small place you've got here for such a big reputation," he commented. "Little cramped for space, aren't you?"

Gus concealed his irritation. "Oh, we manage. . . Now, Mr. Kell, it may take a little time to track down the trouble, so if you've got some business downtown why not drop back in an hour or so? I'll try to have your car ready."

Kell glanced at a gold wrist watch. "Oh, I've got plenty of time. I don't have to be downtown until lunch time. Then I hope to settle a real-estate deal."

Gus looked at Stan and Stan looked at Gus.

"Funny thing, too," Kell went on, as he perched himself up on Gus's stool and lighted a cigarette. "It has to do with a piece of property right down the road here —a corner lot. I happen to hold a small option on it. Some folks want to buy it and they'll have to pay me off if they want the land."

Gus said nothing as he went about checking the engine. He was pretty sure from the sound that the trouble was in the ignition system. Kell hadn't been kidding when he'd said that the other garages had practically rebuilt the engine. It had a new distributor, new coil, new carburetor, new spark plugs.

Kell talked on. Gus, with one ear cocked at Kell and the other at the engine, soon learned that his visitor was a real-estate operator who made most of his money buying up long-term options and gambling that someone else would want to buy the land before his option ran out.

Stan Neglects His Work

While all this was going on, Stan Hicks was working on a car on the grease rack. Actually, he wasn't getting much done. He was listening and wondering what was going through Gus's mind. Kell obviously held the key to the whole deal that the two men in Dan's place had talked about.

"Gosh," thought Stan, "I hope the boss can think up some way to delay this guy."

Just then Gus's head popped out from under the hood of the car. "I think I've found your trouble, Mr. Kell."

Gus started the engine and moved the throttle lever at the carburetor. She took the gas easily without a skip.

"There was a worn spot on the ignition wire leading to the second cylinder and the wire was shorting out the plug. I taped it so it shouldn't give you any more trouble."

"Well, that certainly was fast service." Kell reached into his pocket and pulled out some folded bills. "I can see why you don't need a bigger place. You turn 'em out fast. What do I owe you?"

Option Comes Up Again

"Oh, I guess a couple of dollars will take care of the labor. By the way, where did you say that property was?"

"Right down the road here. Corner lot. Say, you know that spot would make a swell place for you to put up a new garage."

"Could be," said Gus thoughtfully. "Guess maybe it might. What's it worth?"

"Dirt cheap." Kell snapped his fingers. "The owners only want two thousand for the land and I'm willing to let my option go for five hundred."

"But what about the other people?"

"First come, first served, I always say," Kell said briskly. "I've made no binding deal and your money's as good as theirs."

[Continued on page 248]

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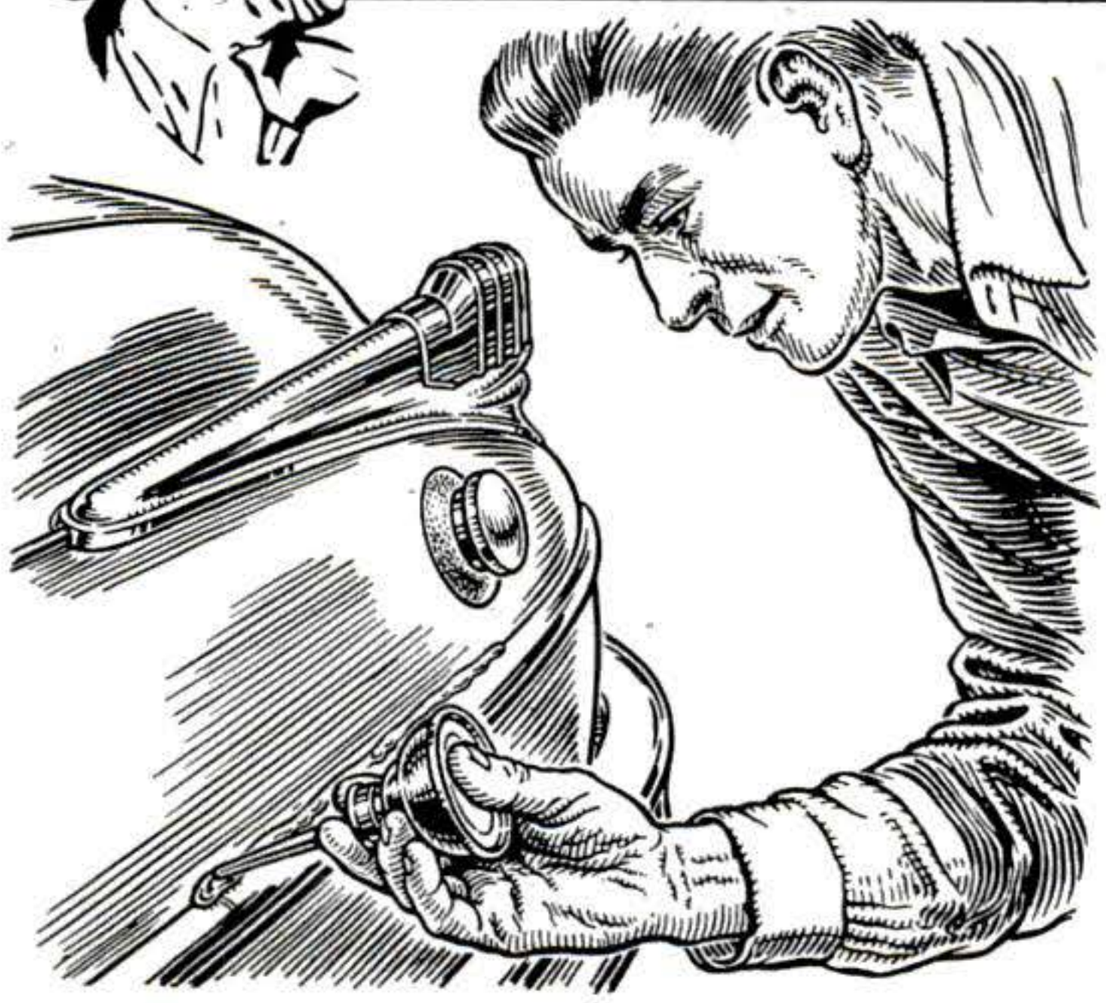
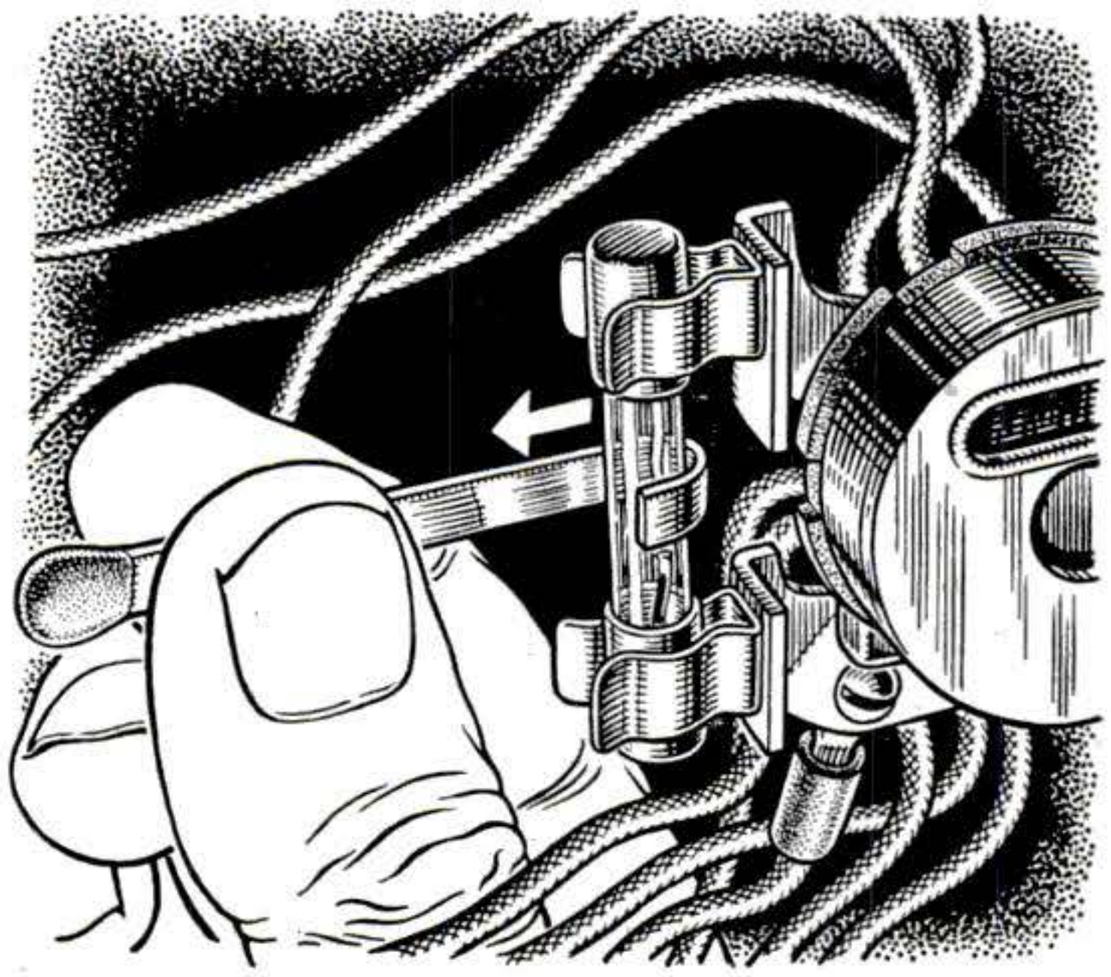
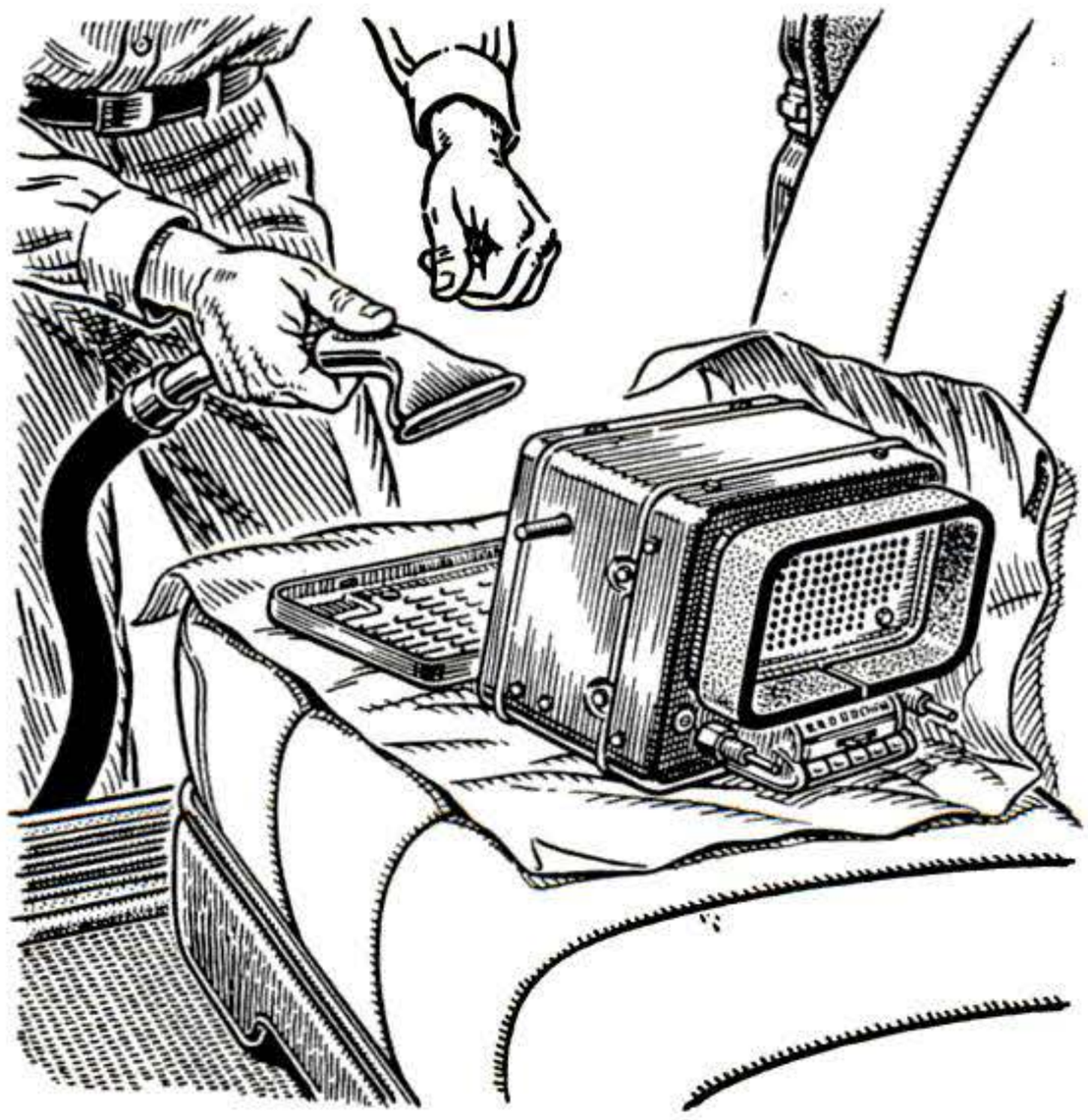
Hints from the Model Garage



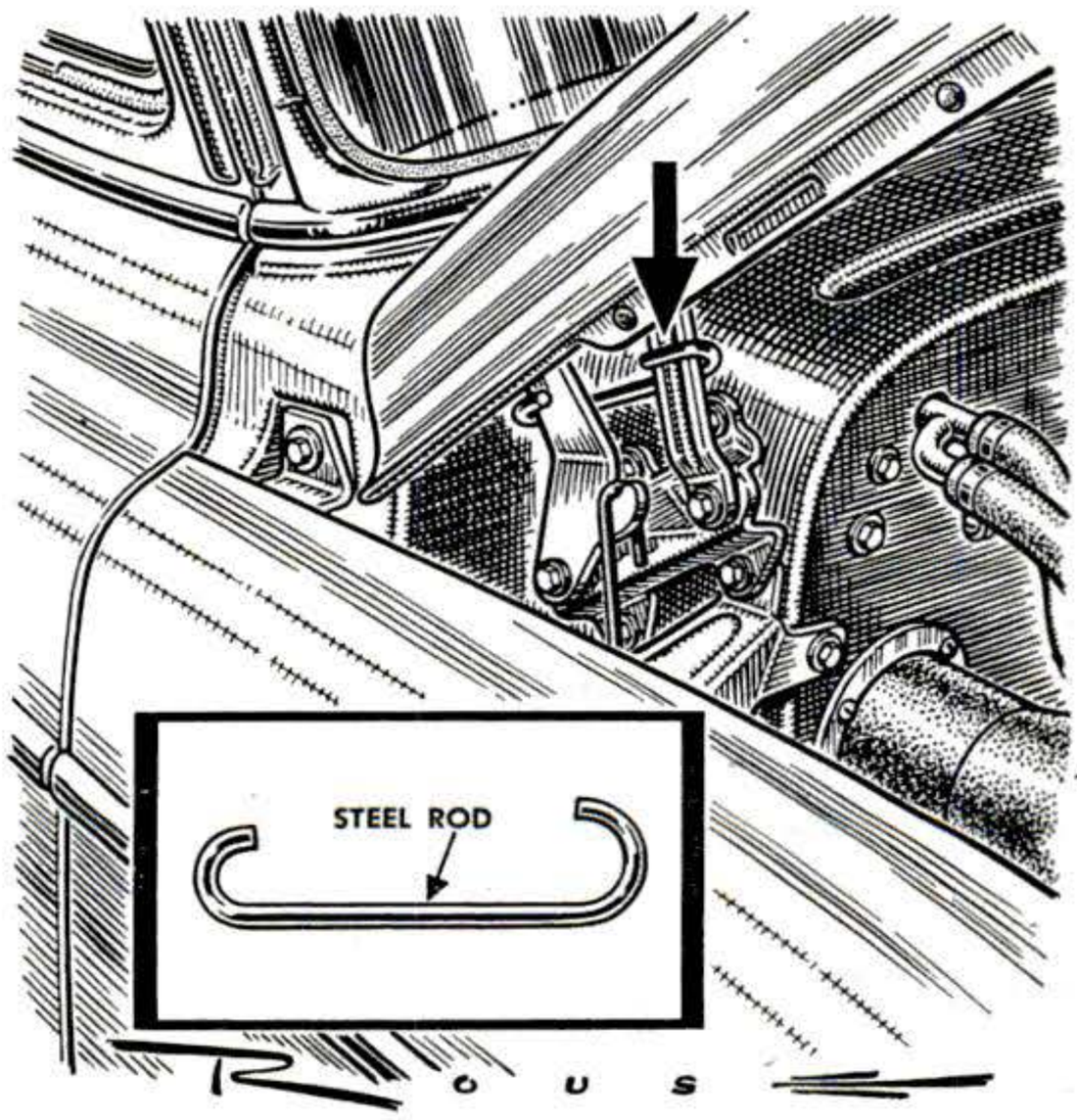
Oil Prevents Hidden Rust. On some cars, moisture is trapped under the trim and molding strips, causing rust to form. Motor oil applied to such places every six months will help prevent the rust. Wipe off surplus oil to keep dirt from collecting.



Hook Removes Fuse. Because it usually is difficult to get your fingers on a fuse, Howard Van DeWater, Kew Gardens, N. Y., suggests that garage workers make up a fuse hook. The one shown was bent to shape from a discarded wiper arm.



Dust May Knock Out Radio. One car manufacturer has traced a number of radio failures to dust blown behind the instrument panel by mechanics using an air hose to clean a car. If your radio has been subject to such whirlwinds, remove it and suck out the dust with a vacuum cleaner. Dust in the tuner lubricant also causes binding.



Lock Keeps Hood Up. If a counterbalanced hood tends to swing down, a C-shaped hook like this may be the easiest fix. Bend it from a piece of ⅛″ steel rod. Raise the hood a bit higher than it usually hangs to put the hook around the struts. The hook serves as a lock because the struts must move apart when the hood comes down.

Please turn the page for more auto hints.

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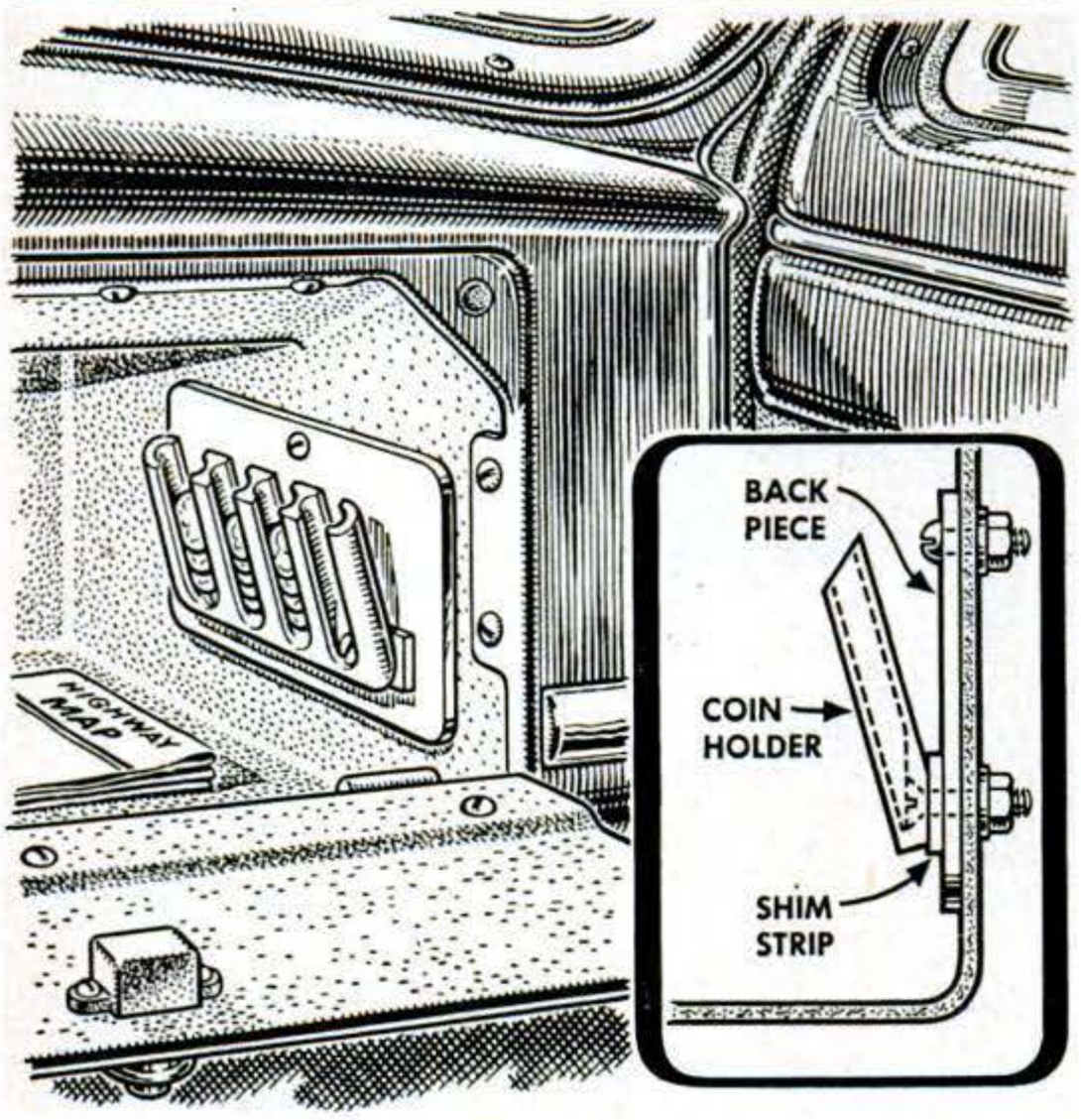
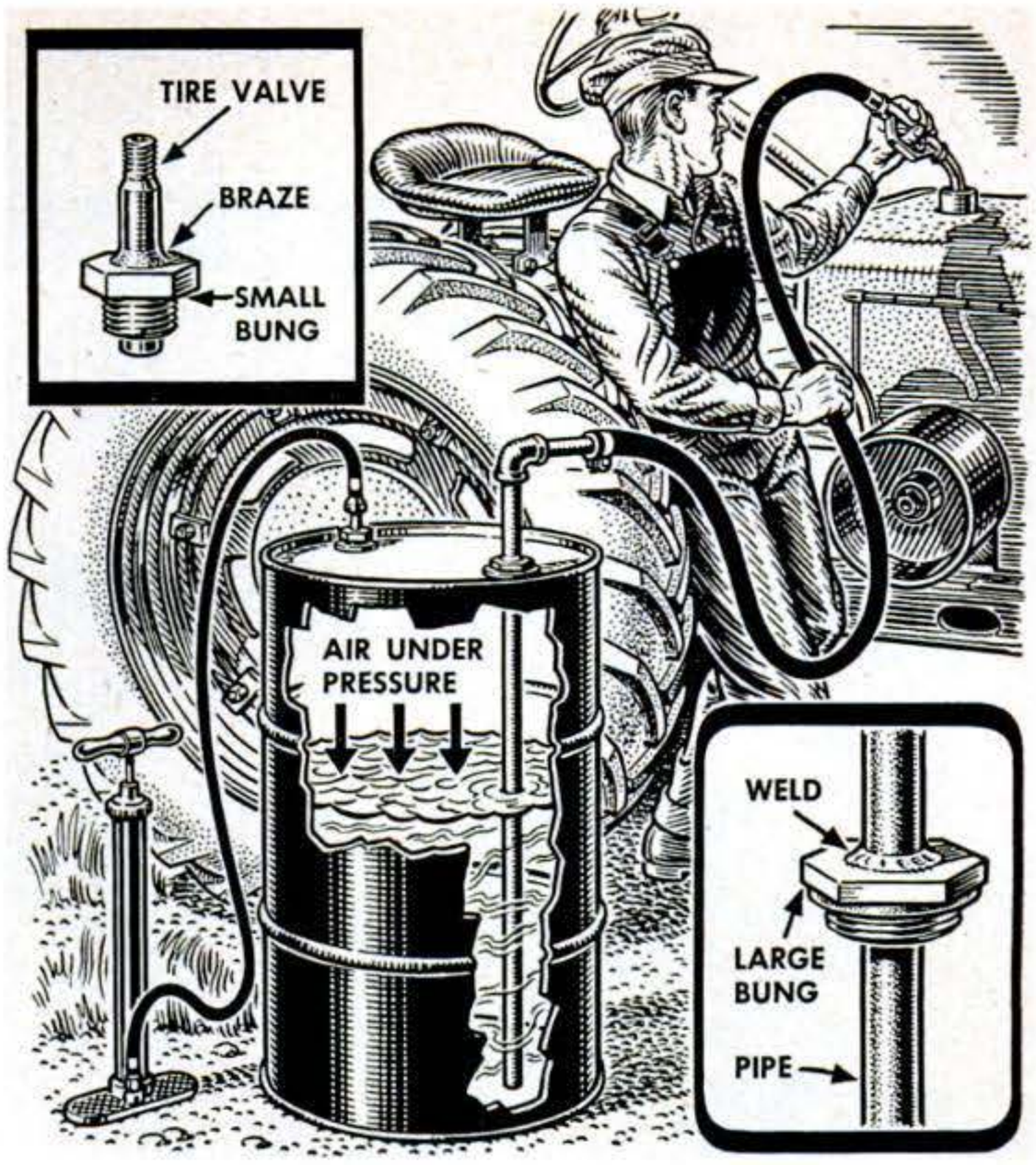
MORE Hints from the Model Garage



Keeping Coins Handy. A supply of change kept in this glove-compartment holder is handy for parking meters and toll bridges and highways. The coin holder came from a woman's purse. (Remember to lock the car when you park.)

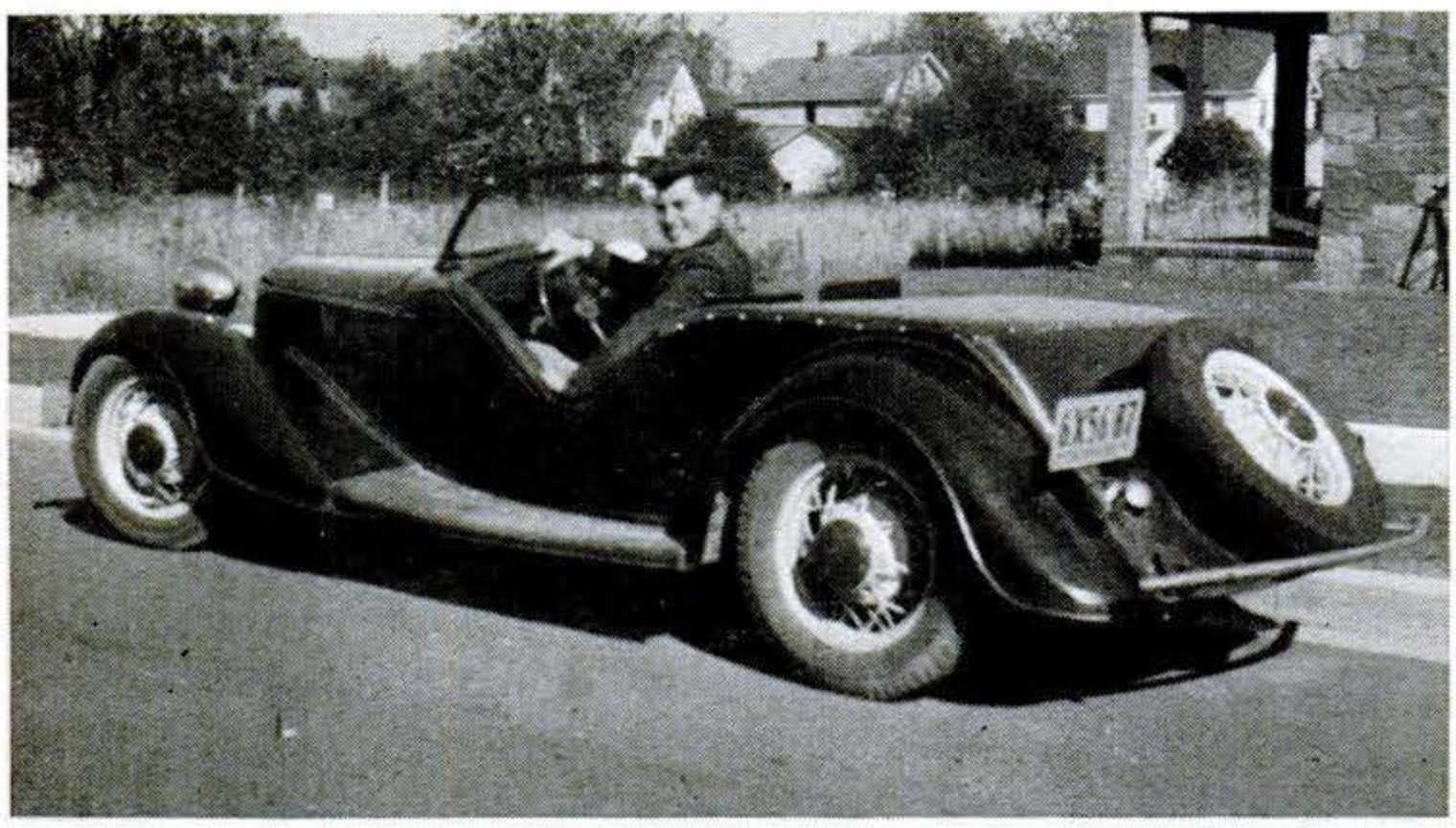


Air Pumps Fuel from Drum. It takes only simple equipment to pump gasoline from a 55-gallon drum. Give the tire pump a few strokes and the pressure will raise the fuel quite a distance. It's best to have a shut-off nozzle on the gas hose.

Glass Blanket Muffles Noise

ATTACHED under a car hood, a blanket of flexible glass fibers deadens engine noise and serves as a two-way heat insulator, keeping the engine warmer in winter and cooler under the hot summer sun. Marketed by P-J Industries of Milwaukee, the Car Hush blanket is applied with a special cement sold with it. The material is fireproof and is not affected by oil.

Eighteen-Year-Old Ford Is Reborn as Low-Slung Roadster



THIS slick job is the work of Carl Pierce, Cortland, N. Y. Basically a 1934 Ford coupe lowered to 8″ road clearance, it has a souped-up 1939 Ford engine. For more responsive steering, the pitman arm was lengthened so the wheel makes only two turns from lock to lock. Brakes are 1940 Ford hydraulic, instruments are from a 1936 Cadillac.

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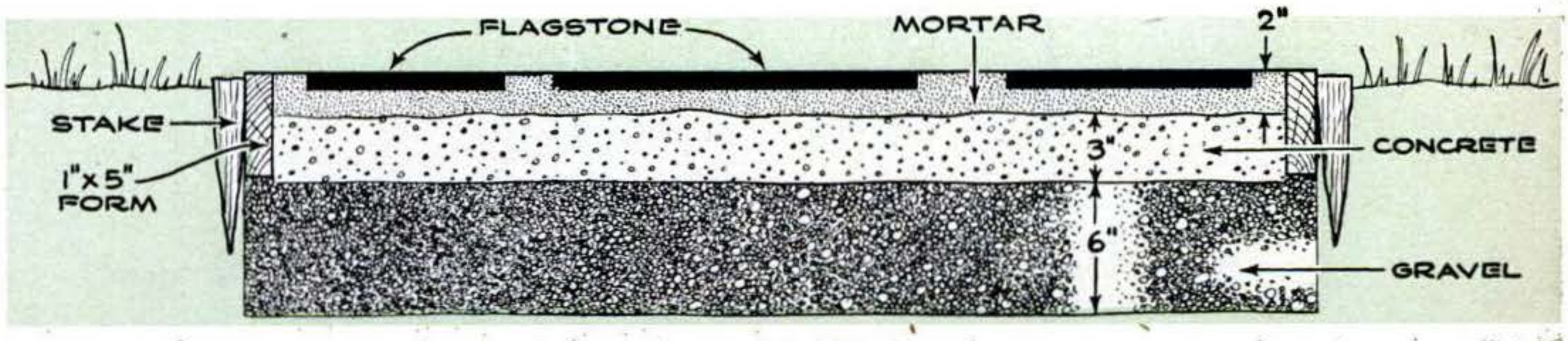
How to Build a Flagstone Walk

There's no prettier way to the door than a flagstone walk. What kind you make depends on your time and your energy.

By Bernard Gladstone

FLAGSTONE is a good choice whether you want a walk that you can put in on a single afternoon or one that will be as permanent and trouble-free as concrete—but a lot better looking. It's not costly, either—I paid about 35 cents a square foot.

Quick and easy. Stepping stones just plopped in the dirt will make a mudless path to your door. While this looks handsome, especially in a country setting, it's



Cross section of walk laid in mortar should look like this. Use cinders or gravel to make base.

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not very practical for a permanent job: the flags usually wobble on pebbles or dirt lumps underneath; frost heaving in most parts of the country will tilt the stones; grass that grows in the cracks is hard to trim.

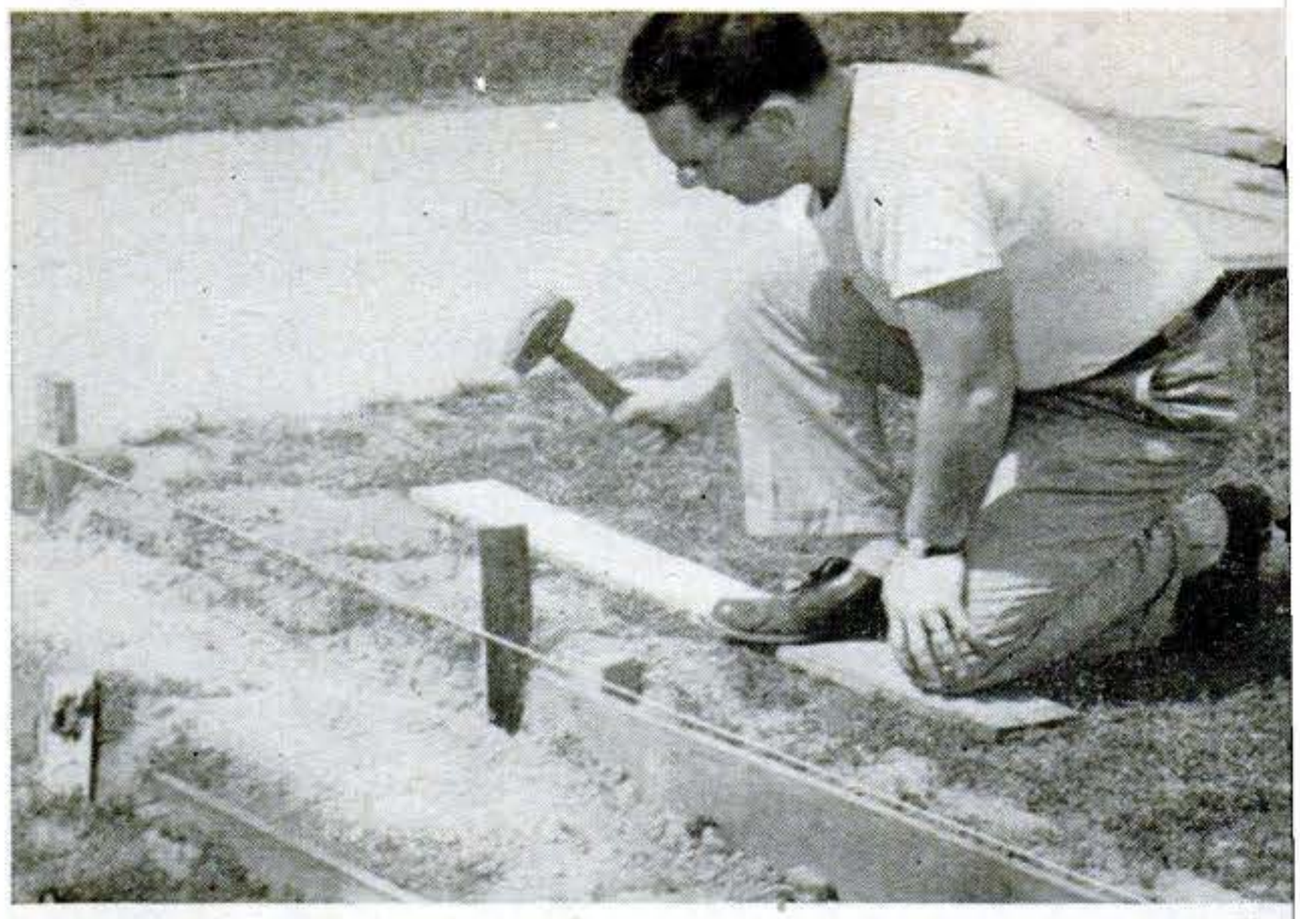
Rustic but safe. If you like the soft look of grass outlining the flagstones, but want a walk that stays level and solid enough for the old folks to use, you must lay the stones on cinders or gravel covered with sand.

Lay out the path with stakes and string—a garden hose is good for establishing pleasing curves first. Then dig out the space between the strings to a depth of about 6″, or more in poorly drained areas. Tamp down a substantial bed of gravel or cinders. Cover with an inch or two of sand, level it, soak with a hose, let it dry, then level again.

Carefully set the flagstones so that they are level and solid. Try to get the upper surfaces at or just above ground level. You may have to scoop depressions in the sand to take bumps on the undersides of the stones; otherwise they will wobble. Fill the cracks with topsoil, then seed.

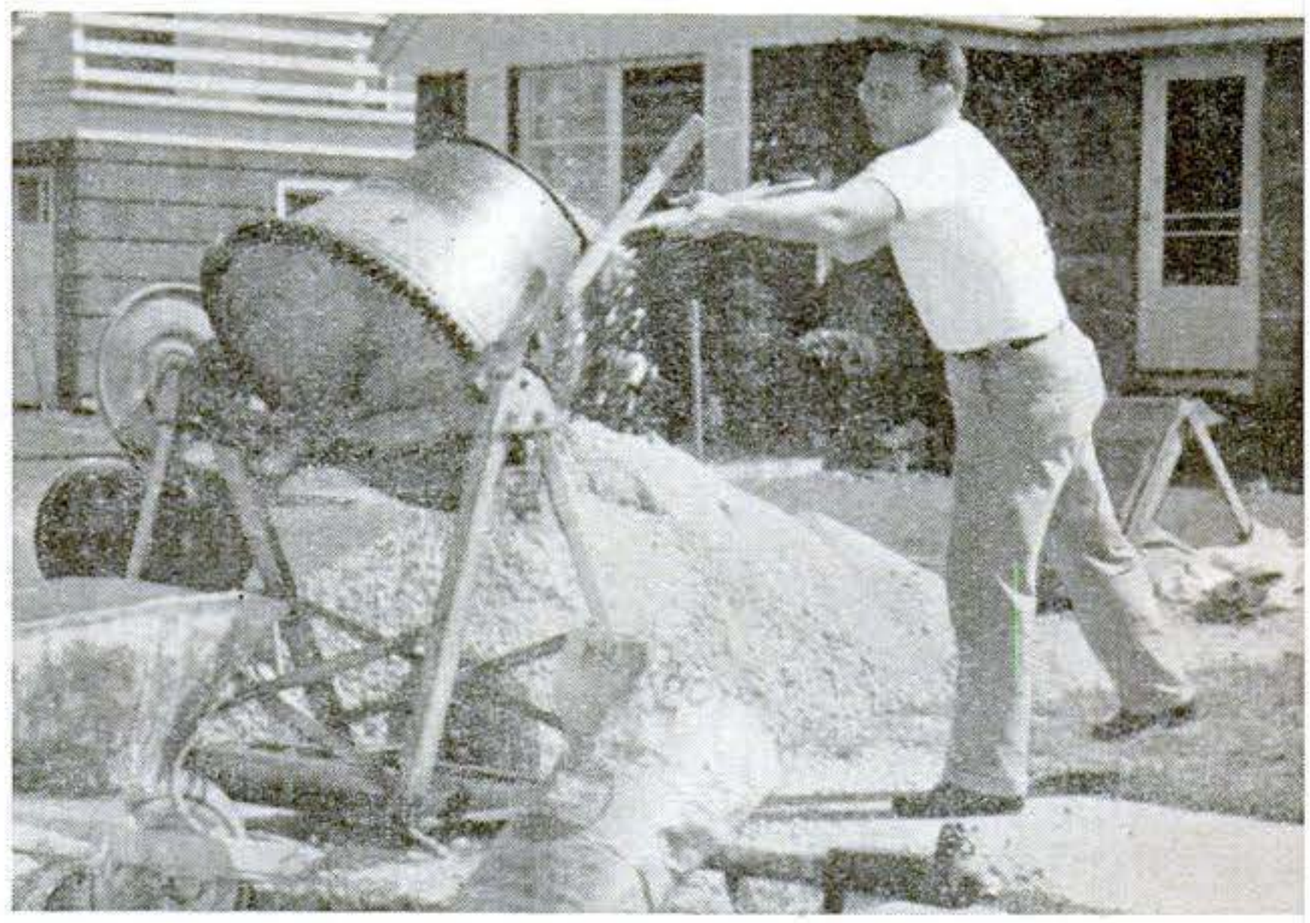
Trouble-free job. To eliminate any problems of grass cutting or snow shoveling, set the flagstones in mortar on a concrete base. The photos on these pages show you step by step how to make such a permanent walk. Here are tips to simplify the job:

- The tops of the form boards set the level, so keep them even. Unless your walk is on a slope, make one side about ¼″ lower than the other to let rain drain off.
- A small concrete mixer—you can usually rent one—will save work and do a better job. A good mixture is 1 cu. ft. of cement, 2 cu. ft. of sand and 3 cu. ft. of gravel. You'll need about five gallons of water to a cubic foot of cement if the sand is just damp, 4½ gallons if the sand is so wet you can squeeze water out of a handful.
- You can lay the flagstones the day after the concrete bed is poured, but for best results it should cure about four days under a covering of wet hay or burlap.
- Lay out the stones in the pattern you want, arranging them to avoid long lengthwise joints. Then set them next to the walk in the order in which they will be used.
- Clean off mortar with a wet rag and trowel after laying each section of about 10 square feet. After the mortar has set a few days, clean off the milky film coating the stones with muriatic acid. Dilute the acid you get from the paint store with five parts of water. Finally, flush the walk with a hose.



LAYING OUT THE WALK. Drive stakes and string cord to frame walk area. Then dig a trench along the inside of the cord.

SHARPLY CURVED FORMS. Use sheet metal —about 14 gauge—bent to the curve and nailed on. Metal needn't be as wide as boards.



MIXING CONCRETE. If you rent a small mixer, you'll save yourself a lot of work and time. Electric motor runs this one.

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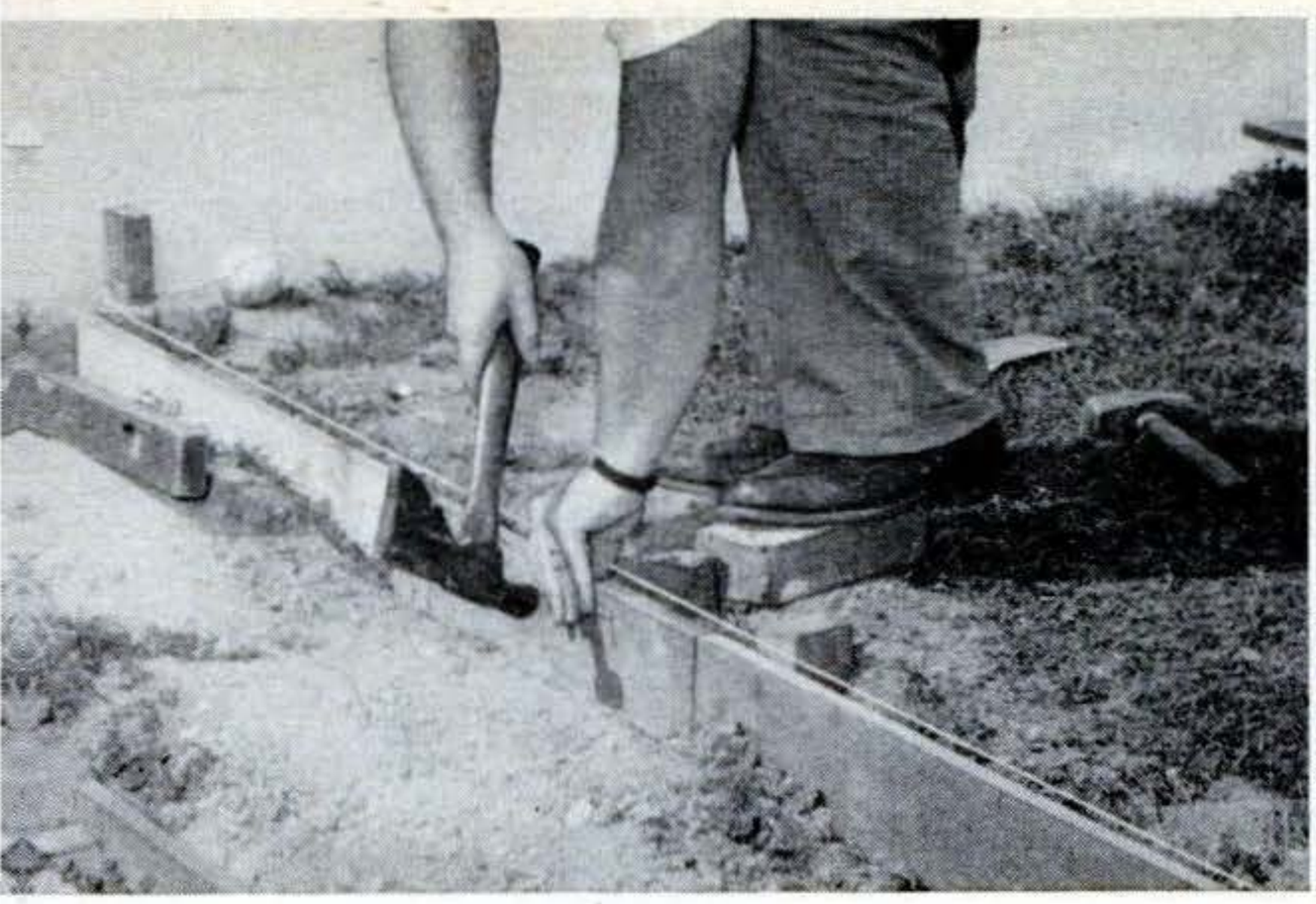
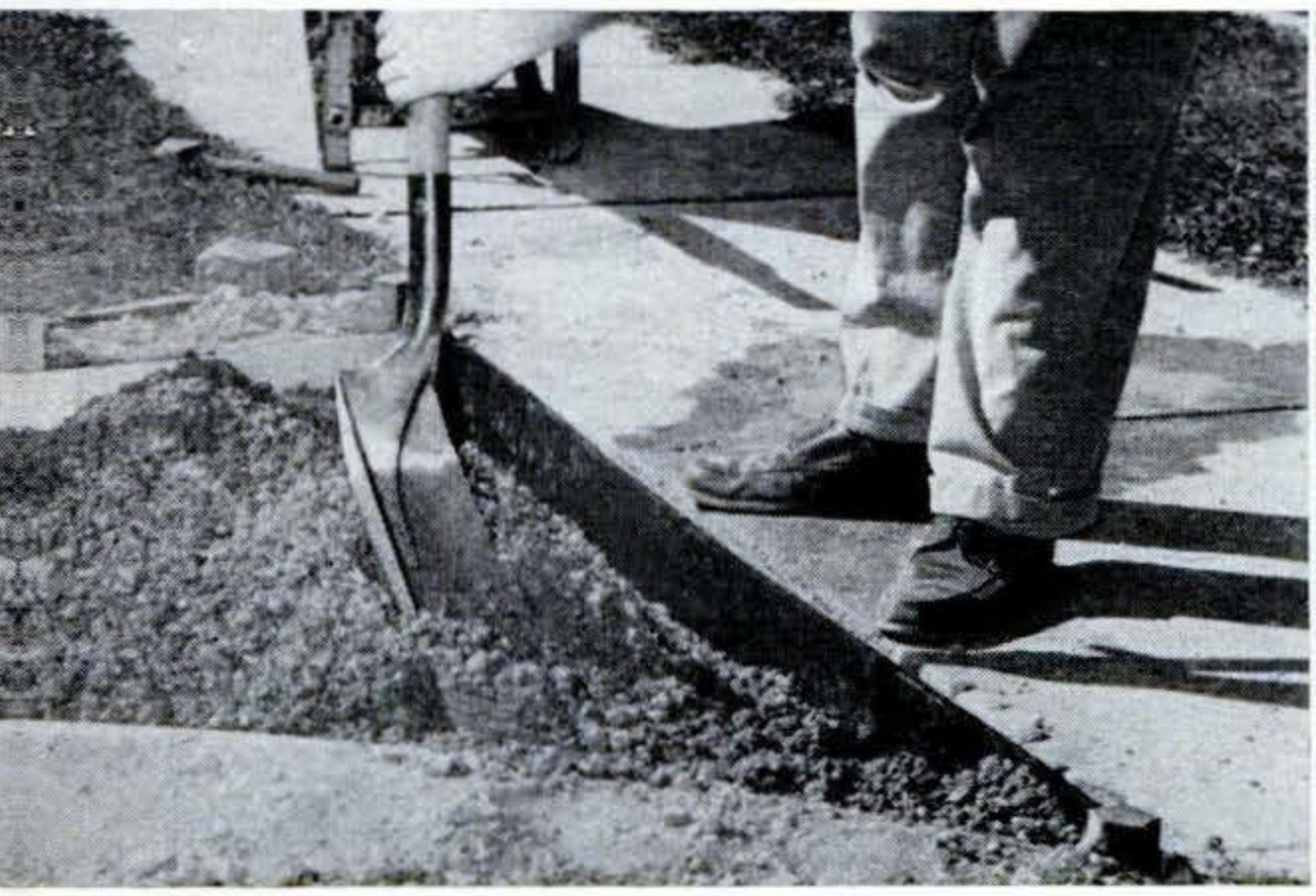


2 STRAIGHT FORMS. Drive stakes every 3′ or 4′. Set 1″ by 5″ boards in trench with top edges 1″ above ground. Nail boards to stakes.

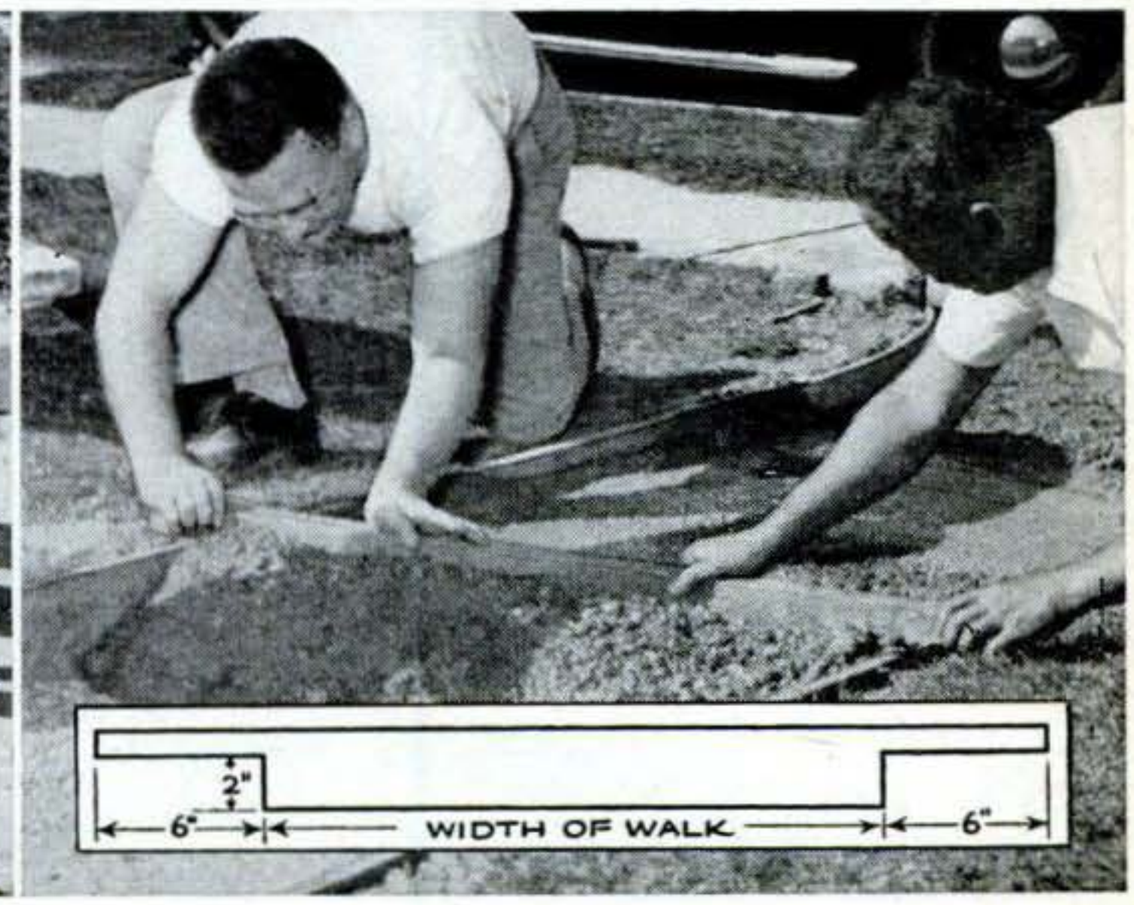
3 CURVED FORMS. Use ¼″ plywood 5″ wide or any ¼″ lumber. You can bend it around gentle curves. Dig out soil between forms.

5 TAMPING FILL. Cinder or gravel fill is needed to prevent cracking unless soil is very well drained. Put in 6″ of fill, tamp solid.

6 EXPANSION JOINTS. Wherever your new walk will meet a foundation, curb, stoop or sidewalk, put in a piece of tarred felt.



8 SPREADING CONCRETE. Haul the concrete from the mixer in a metal wheelbarrow. Use a shovel to poke the mix into corners.



9 LEVELING CONCRETE. Use your strike board to level the concrete to within 2″ of the top of the forms. A helper is useful here.

Please turn the page for more flagstone photos.

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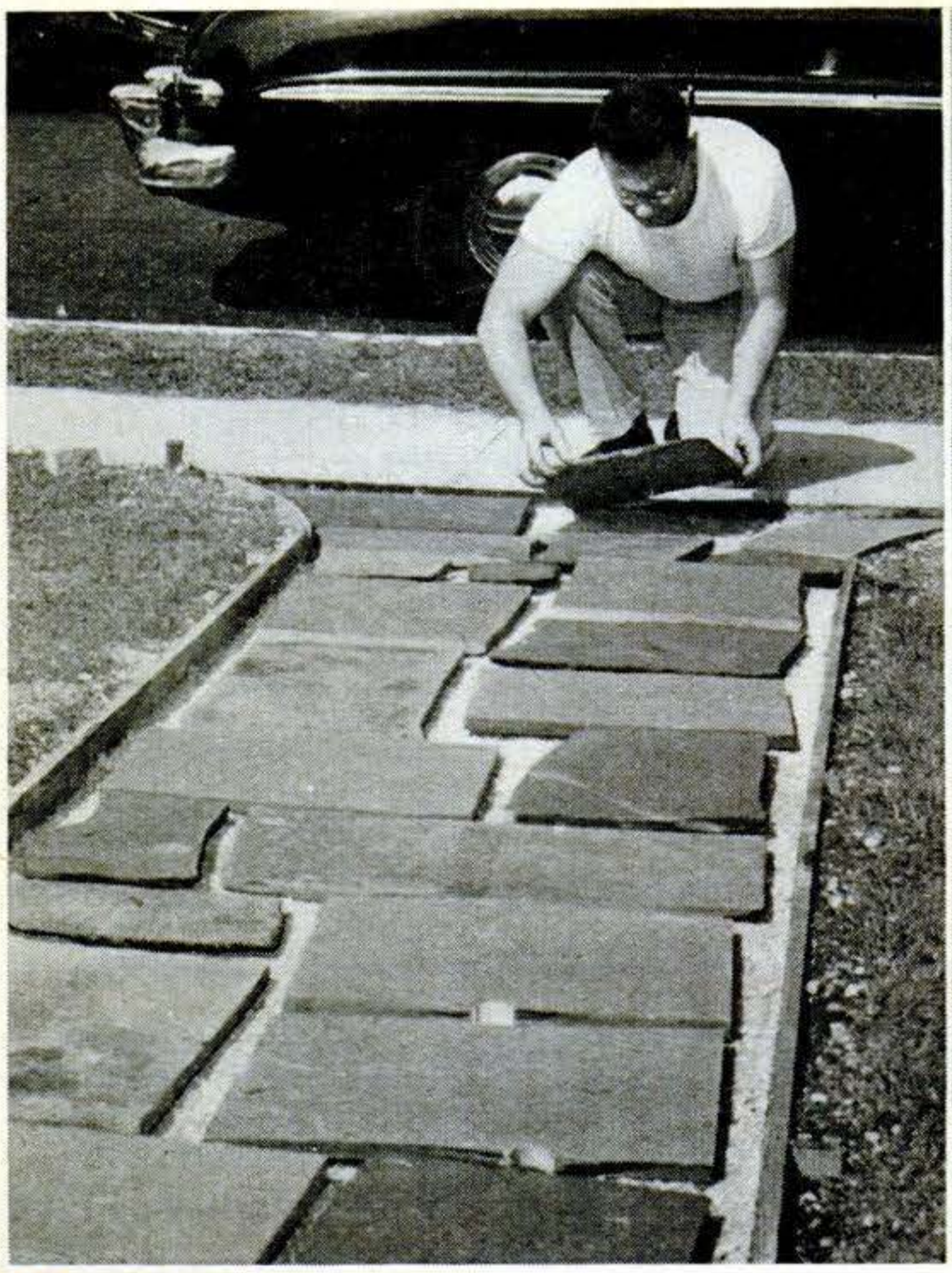
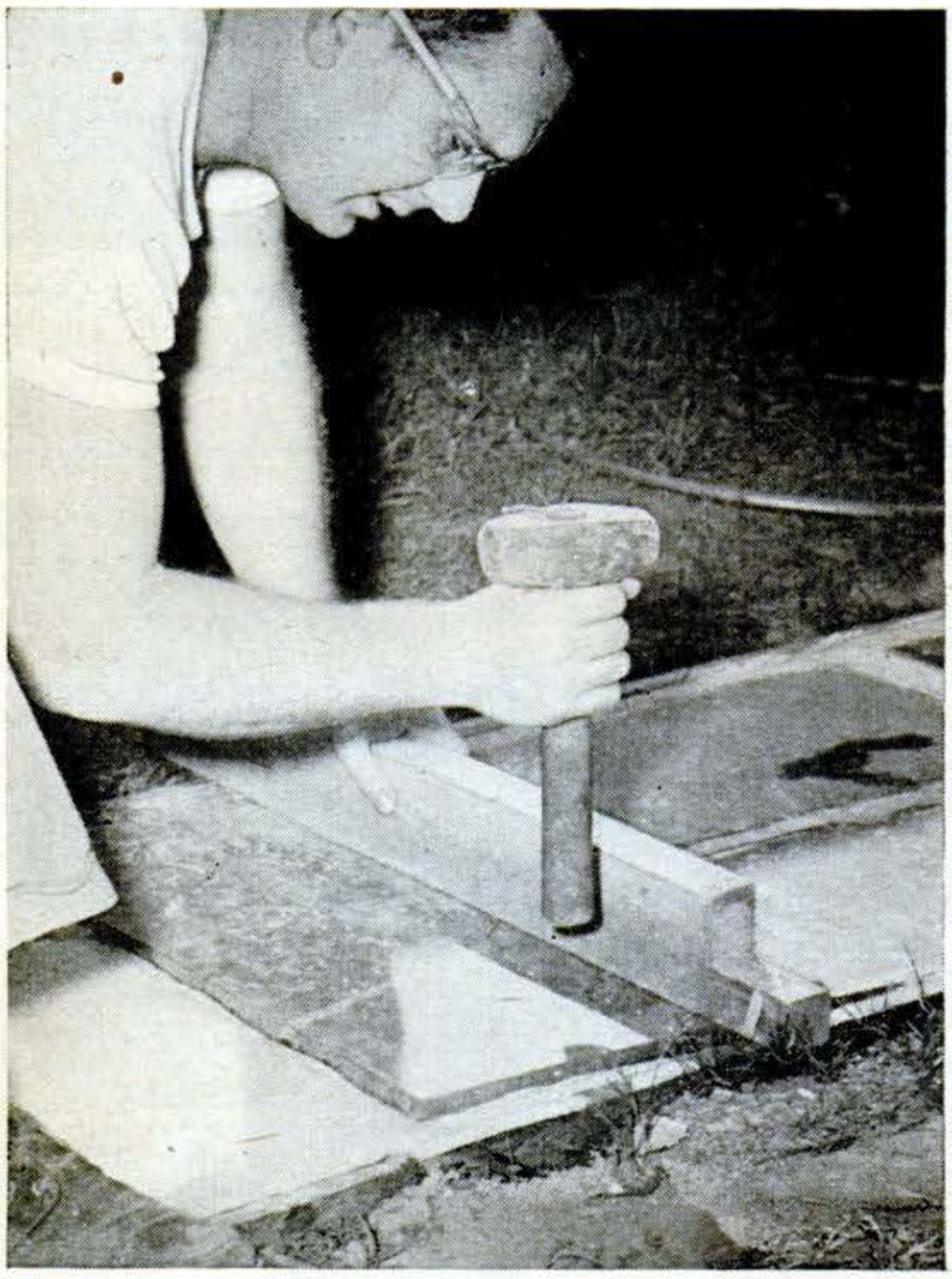


10 FLAGSTONE LAYOUT. Lay out all your flagstones like the pieces of a giant jigsaw puzzle. Allow about 1″ for joints.

11 CUTTING FLAGSTONES. To shape a stone, place it on a stout box or block. Hit it sharply with tire iron or auto leaf spring.



13 SETTING FLAGSTONES. Place mortar to bring tops of stones level with forms. Use your strike board as a level.

14 FILLING JOINTS. After you have set and leveled 10 square feet of stone, double back and fill joints with mortar.

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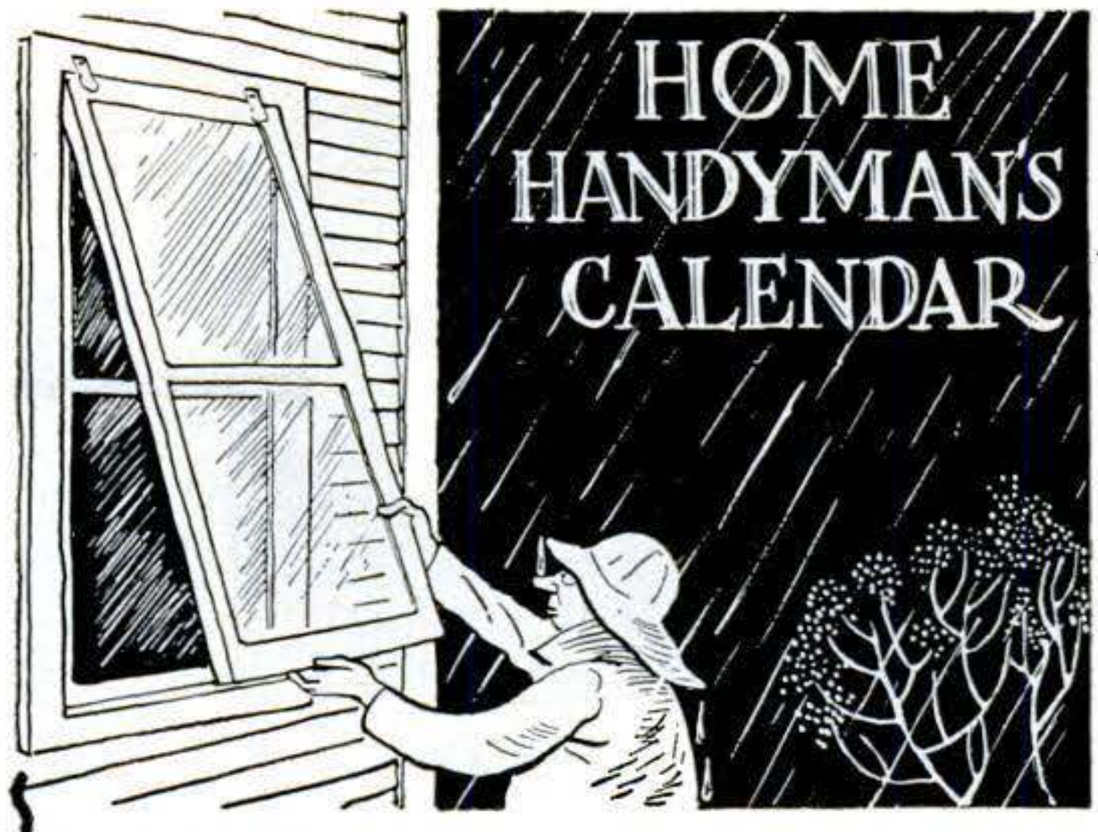
12 SPREADING MORTAR. Mix one part white cement to three of fine-screened sand. Wet concrete bed; trowel mortar to 1″ layer.

SMOOTHING EDGES. Use edging trowel to finish joints along forms. If mortar has started to set, dip edging trowel in water. END

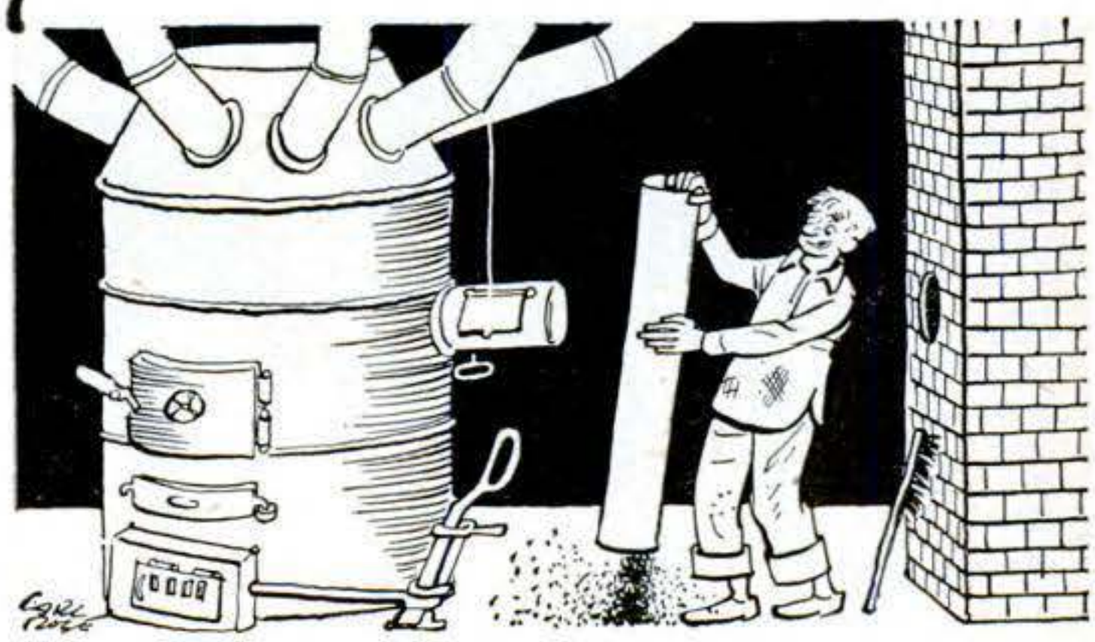


April hints at summer days ahead. It's safe now to take down the storm sash and put up screens. Stack the storm windows vertically on a dry floor or in racks. If any need repainting, it's better to do it now.

- Outdoors, inspect your trees. Winter-weakened limbs that overhang walks, drives or utility lines are hazardous. Find them before foliage hides the branches. It's a good time, too, for termite patrol, watching for mud-like tubes the size of a pencil on inside and outside cellar walls. They mean trouble.

- Indoors, repair and paint flower boxes and trellises. Prefabricate and paint fences that you'll be needing soon. Oil fans and motors and build storage shelves.

- When you shut down your heating plant, don't just turn it off and forget it until autumn. Clean smoke pipes and boiler and remove accumulated rust. While the chills of winter are still fresh in your memory, survey your house to see where insulation might eliminate drafts and cut next winter's fuel bill.



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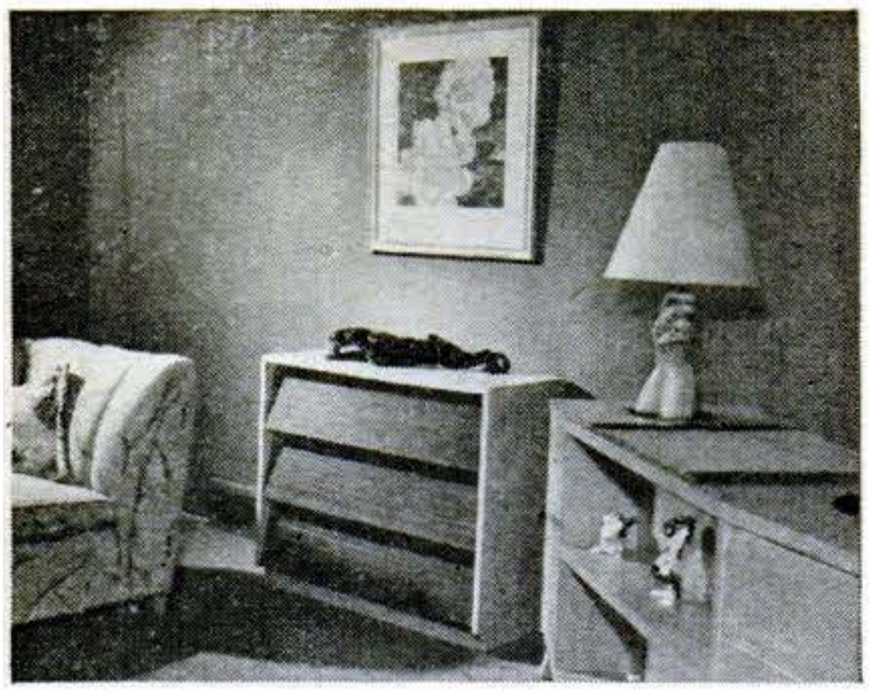
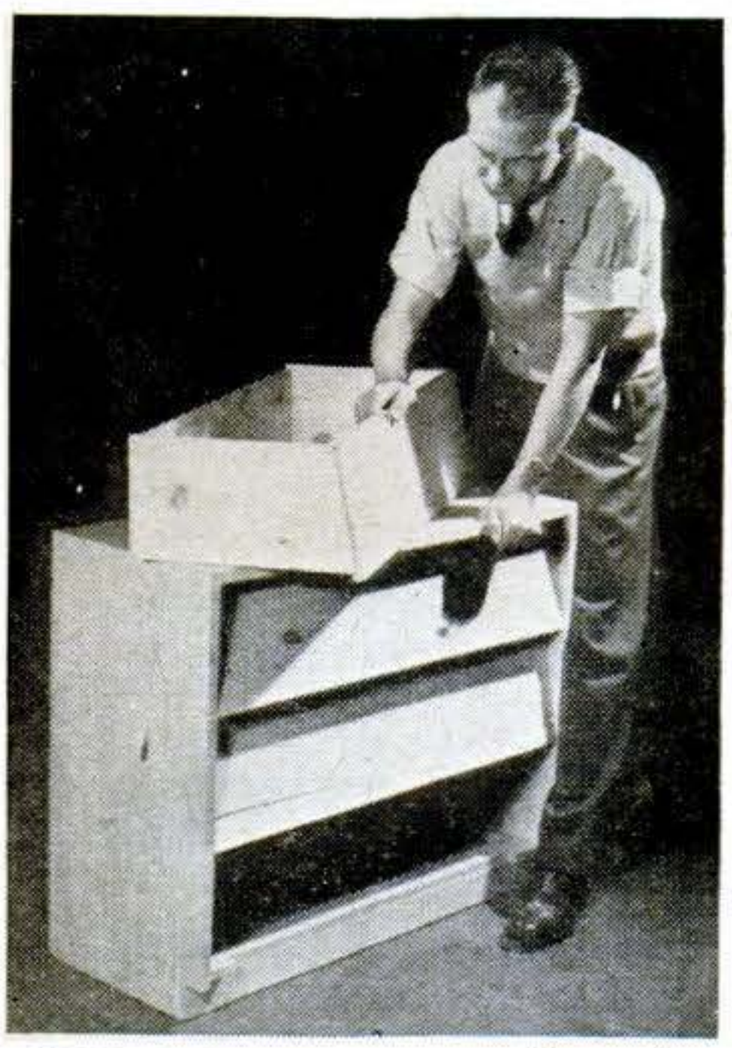


WHO'D GUESS the chest was unfinished pine? It matches the limed-oak piece, cost only a third as much.

Decals Put Fine Grain on Cheap Wood



THIS MODERN CHEST, bought unfinished, had knots and pitch pockets that would have spoiled a stain-and-varnish job. But with plastic veneer, such defects don't matter provided they are solid and sanded very smooth.

You can have a modern blond finish on old dark-toned furniture . . . or transform bare pine into mahogany or walnut.

THE time you begin to appreciate the furniture you have is when you try to buy a matching piece at today's prices. One look at the dollar sign on mahogany or walnut may speed you to the unpainted-furniture department.

This kind is cheaper, but tags you with a tough finishing chore. And no amount of skill or elbow grease will make softwood look like Circassian walnut or limed oak.

A neat way out of this fix is to shelve your paintbrush and do your finishing with a sponge, a razor blade and a squeegee. These are the tools used for applying plastic-decal veneers, which look almost more like wood than the stuff off the tree. The plastic decals shown in the accompanying photos, made by The Meyercord Co., Chicago, can

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be purchased at department, paint and hardware stores.

With decal veneers, two-tone effects are easy, hiding plywood edges is simple, and matching grain is no problem at all. Nor is it any harder to convert old dark-toned pieces to blond ones. You apply veneer right over the old finish.

Beauty is film-deep. Plastic veneers, long used for automobile trim, metal furniture, and radio cabinets, come in a variety of grains and wood tones, and there are also some marble and tooled-leather veneers.

The pattern is printed on a thin but tough plastic film. Like most other decals, it comes with a heavy paper backing that you soak off. But unlike dime-store transfers, the veneer doesn't stick by itself. It must be put on with a special cement. After this has set, the film is protected with a coat of varnish, lacquer or shellac.

You can buy the veneers in two sizes: 24″ by 34″, and 34″ by 48″. At current prices, they come to about 25 cents a square foot.

What you can cover. There's one must in veneering with this material: the surface you apply it to must be as smooth as a baby's jaw. Scratches, pits, pores and pronounced grain will stubbornly show through and spoil the effect.

Open-grained woods like oak do not cover well. Nor does wood with wild grain, like fir. In shopping for unfinished furniture, pass it by if it's made of fir. Even long-winded sanding won't kill its coarse grain.

Any close-grained wood can be veneered successfully. So can hard composition board, tile, glass and metal. On old work, first clean off all wax and furniture polish with alcohol or turpentine. Fill dents and gouges with putty, sealing wax or crack filler. Then sand the filler perfectly flush. If the old finish is badly chipped, cracked or peeling, it will be wise to remove it completely.

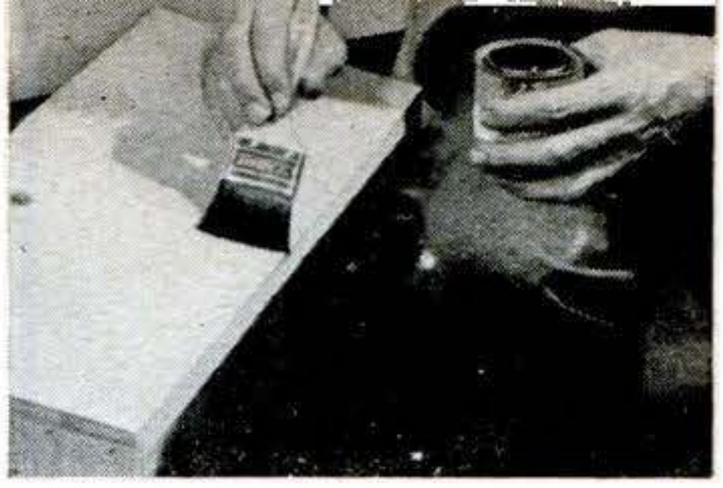
Sealing is the secret. On new wood, or old that you've stripped down, the first step is sanding. Even if you must start with medium paper to work out deep scratches, be sure to finish with 00 or finer. Try for a satin-smooth surface. Your finished job won't be any better than the surface you have right now.

Every bit as important as sanding is sealing. The pores of the wood must be made watertight, since the veneer is applied wet. You can seal them with shellac, lacquer or varnish. Shellac and lacquer dry fast, permitting you to apply a number of coats quickly.

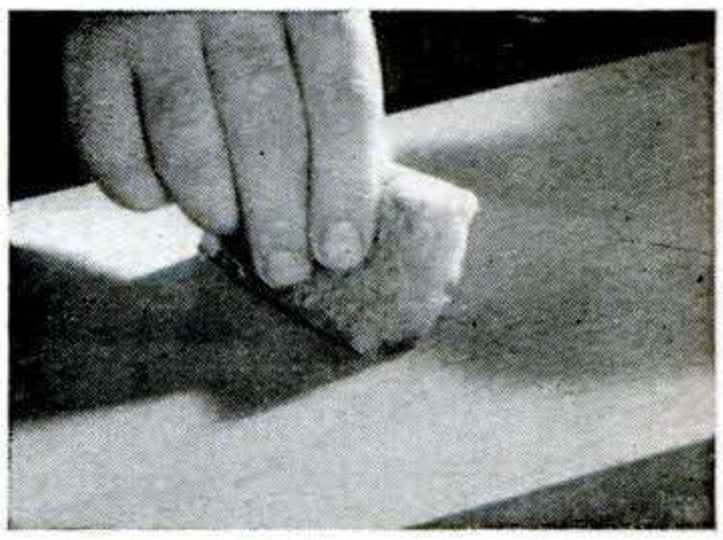
For the first coat, thin the sealer with two-thirds as much of the proper solvent (alcohol for shellac, thinner for lacquer, turpentine for varnish). This will let it penetrate the grain more readily. After the first coat has dried thoroughly, sand with fine paper to smooth any raised grain and remove dust nibs.

Follow with another coat, less diluted than the first. Sand again, and apply a third full-bodied (undiluted) coat. Steel-wool the final coat lightly, being careful not to cut it down to bare wood.

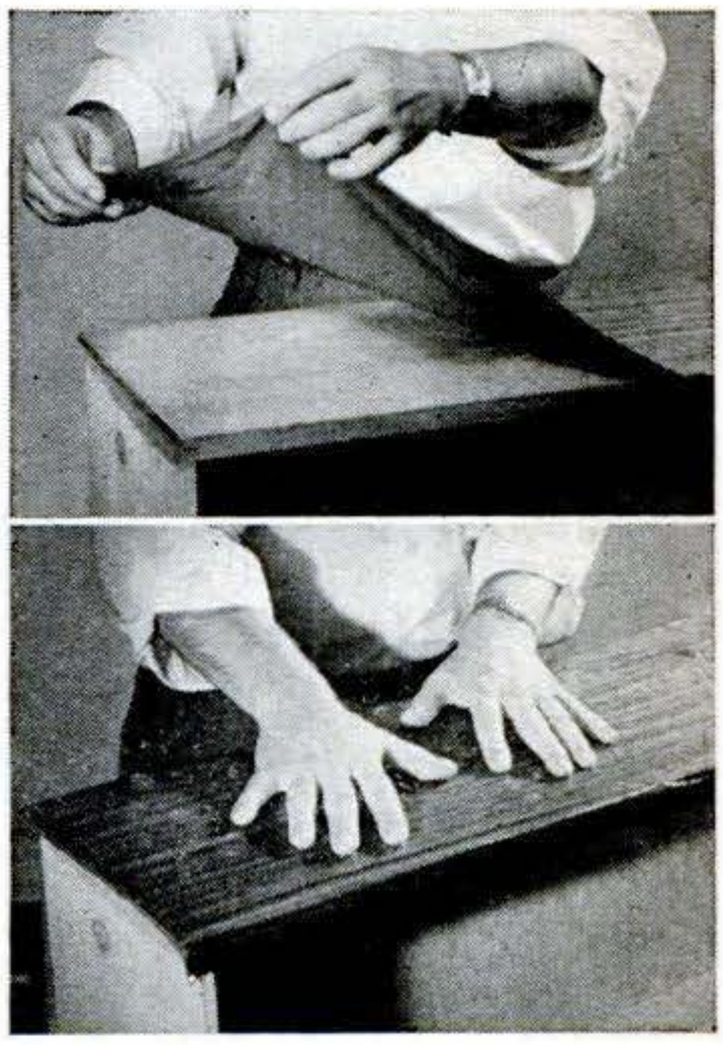
Now apply the decal. Hold the veneer sheet up to a strong light so that you can see the way the grain runs. Then measure off on the paper backing a piece to fit the



SEALING IS VITAL on new wood. Thin the first coat of shellac, lacquer or varnish. Sand lightly between coats, using at least three. If pores aren't sealed, water from veneer will raise grain under the film, spoiling the job. On old finished surfaces, all you have to do is fill defects and sand smooth.



AFTER CUTTING VENEER to size (be sure to allow for edges), apply the special cement to the surface to be covered. Use a cellulose sponge. Meanwhile, let the cut veneer sheet soak in a pan of cold water to loosen the film.



LAY SOAKED VENEER face down on the surface and peel off the paper backing. Then lift film carefully to square it up with the surface, as in upper photo, or slide it about (lower photo), working out wrinkles and bubbles. Be sure the film overhangs edges you want to cover.

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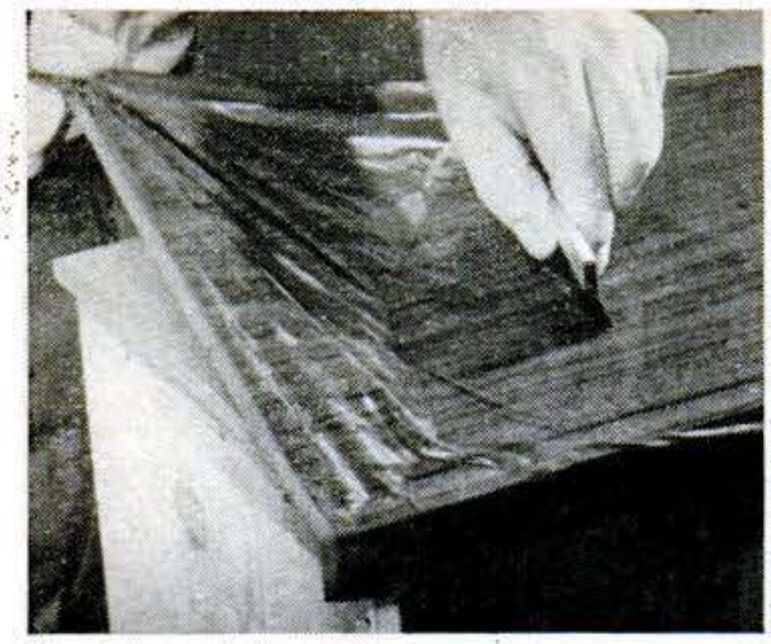
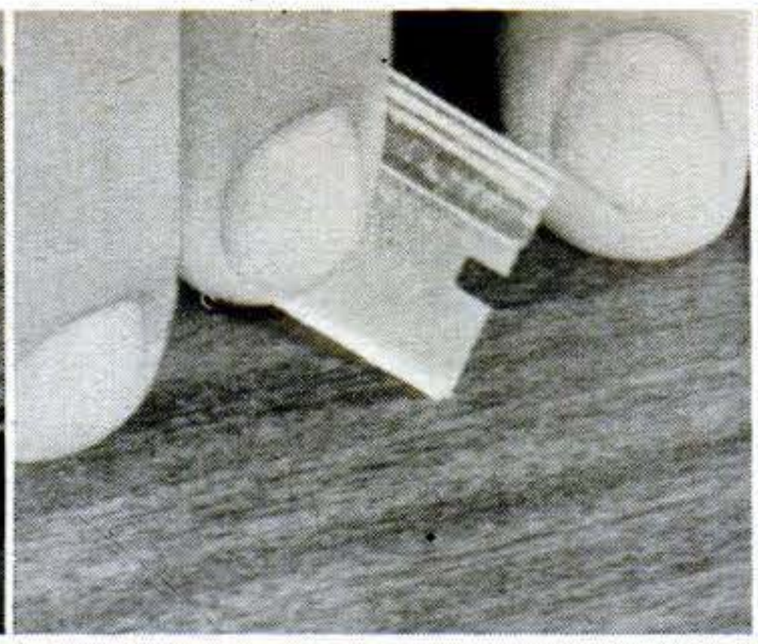
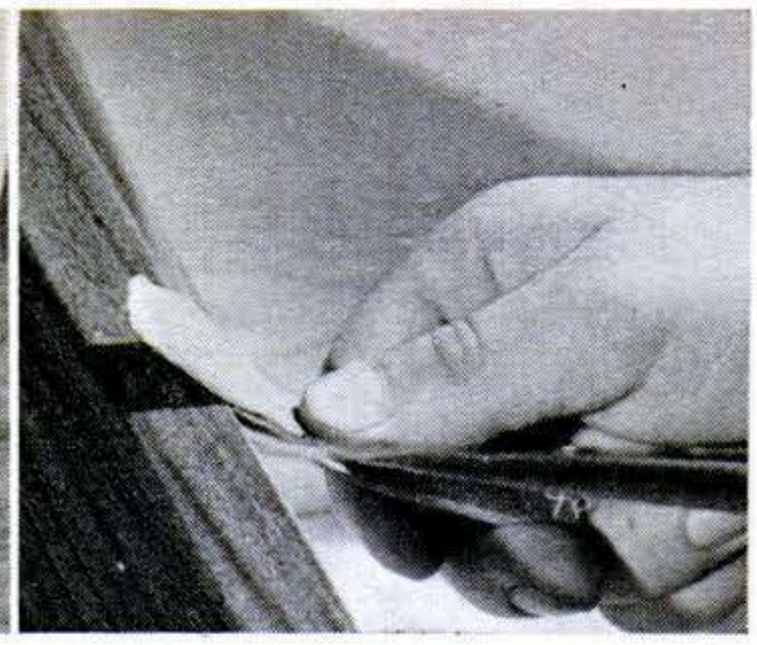


WET THE SQUEEGEE and smooth out the veneer with it. If wrinkles persist, lift one end of the film and follow it down with the squeegee, as above. Always squeegee out from the center toward the edges, first lightly until wrinkles are smoothed, then firmly to press the film on.



TRAPPED BUBBLES may show up just when you've smoothed the sheet perfectly, or even after the edges have been veneered. To flatten them, push bubble into as small an area as possible with the fingers, puncture center, squeeze air out of the hole, and squeegee film flat.



BEND FILM OVER EDGES. At corners, make neat miter folds, as in wrapping a parcel. Trim off folded triangle along corner with a razor blade. To trim along edges, fold sandpaper into a strip, or roll it on a pencil. Stroke downward along the sharp arris as above.

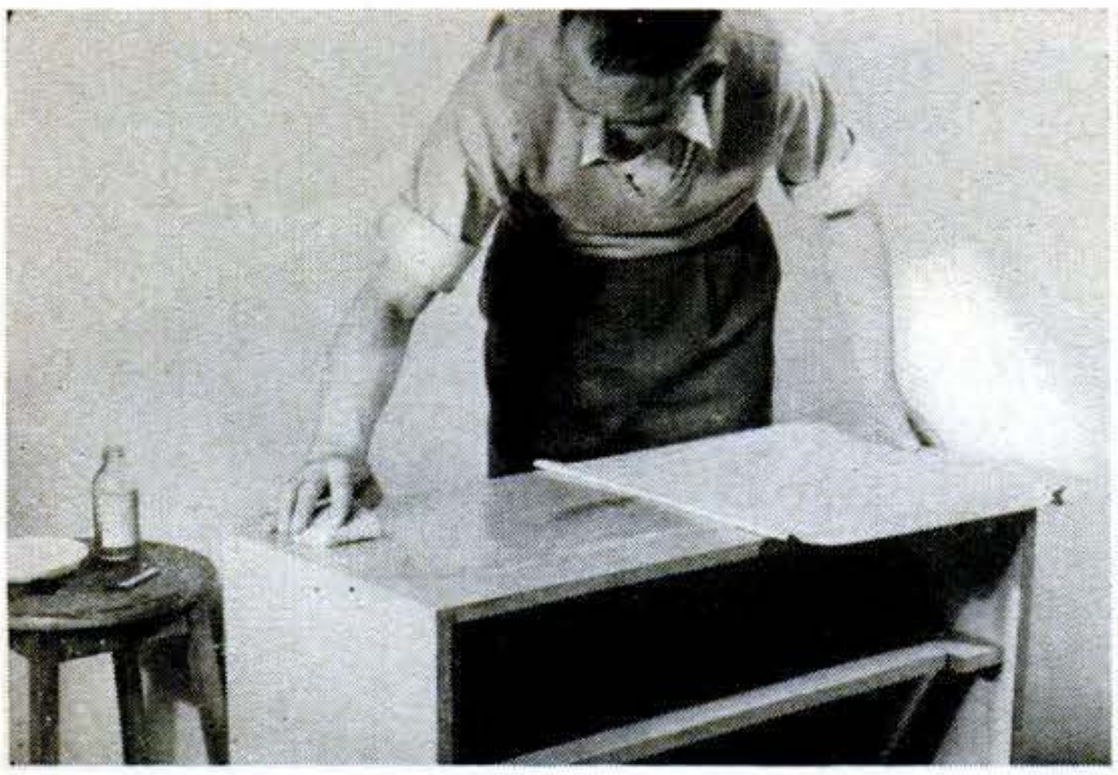
surface to be covered. Allow ½″ extra each way for trimming, and be sure to add the width of any edges you plan to turn the veneer over. Cut on the backing side, using a straightedge and a razor blade.

Roll up the cut piece lightly and put it in a pan of clean water. On the backing, the sheet will be marked "Simplex" or "Duplex." Simplex film will soak free of the backing in about a minute; the Duplex type may take five minutes. Gently shake off excess water, and lay the veneer, with the backing up, on the surface to be covered. On small areas, apply cement before placing the veneer. On large ones, fold back half the film at a time to coat the surface with cement. Both methods are shown in the photos. After the film is in place, peel off the backing.

If one sheet won't cover an area, lay a second one in place with a small overlap. Then cut through both veneers in the middle of the lap, peel off the two strips of waste, and you'll have a perfect butt joint.

Trim it with sandpaper. At the back of a chest or cabinet, the veneer may be folded over the edge. But where a side joins the top or front, it is better to cut it flush with the edge. Wrap a piece of sandpaper on a pencil and stroke downward along the sharp edge (arris) to cut the film cleanly.

After 48 hours, the cement and film will be dry and firm. Apply a protective coat of lacquer, shellac or varnish. A semigloss luster is recommended for wood-grain veneers. For marble effects, you may prefer a high-gloss topcoat.—*H. R. Pfister, The Bronx, N.Y.*



ON BIG AREAS, like the top of this chest, don't apply cement first. Instead, align the soaked sheet of veneer, pull off the backing, and fold back half the film as at left above. Then sponge cement on the uncovered half, and gently lower the folded part of the sheet back into position, as at right, smoothing it with the wet squeegee as shown. Next, fold back the other half and repeat the process. Be sure to apply cement right up to the center.

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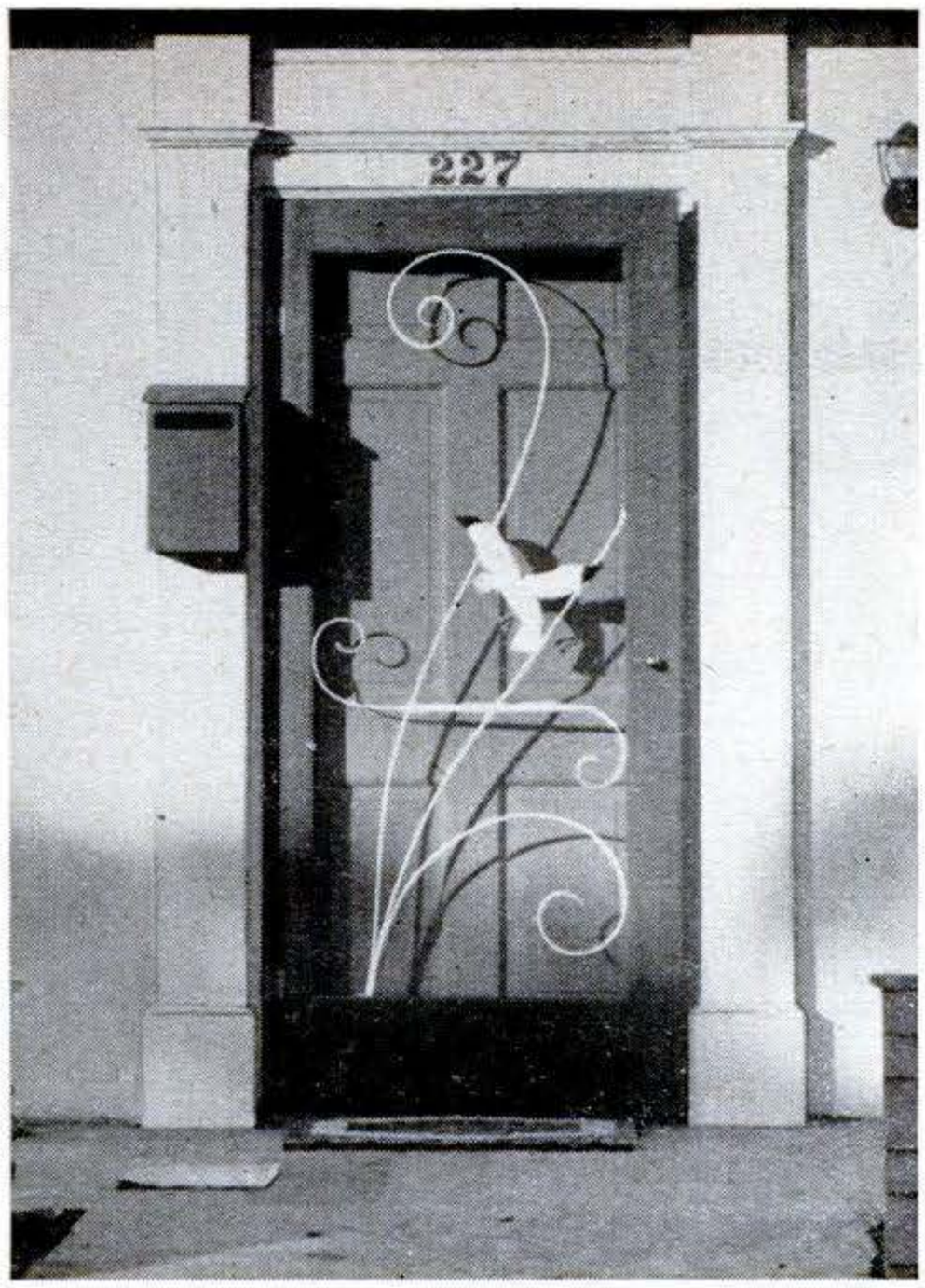
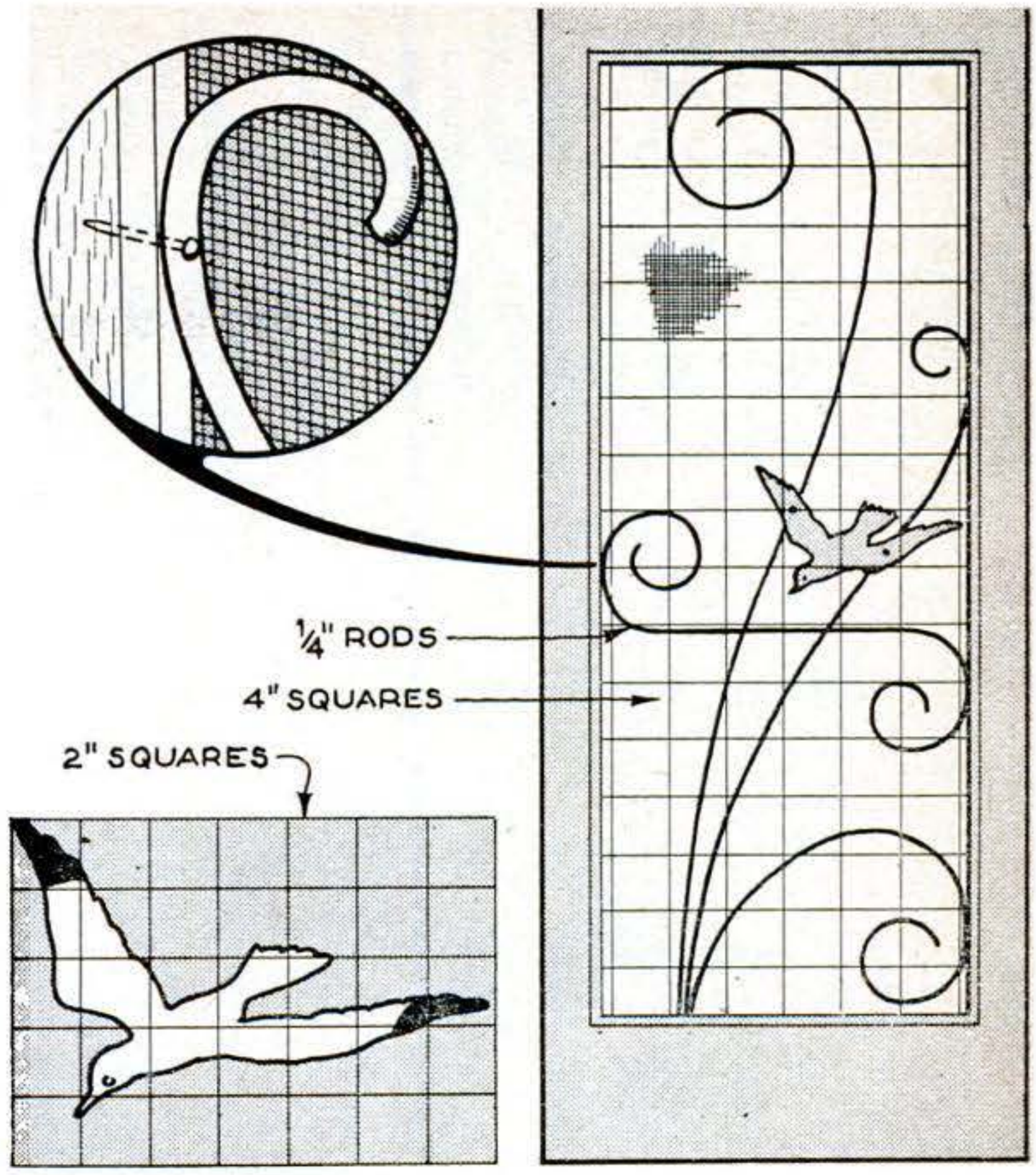
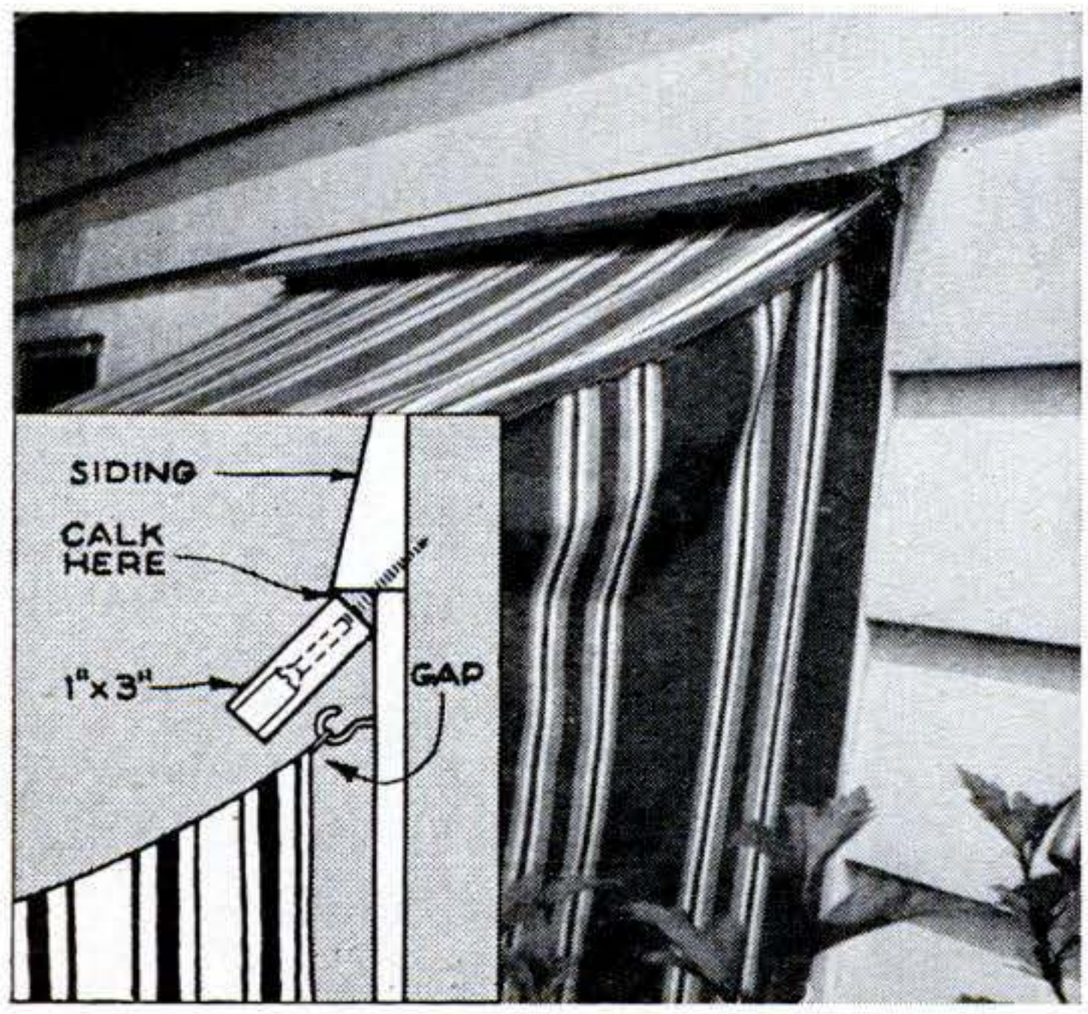




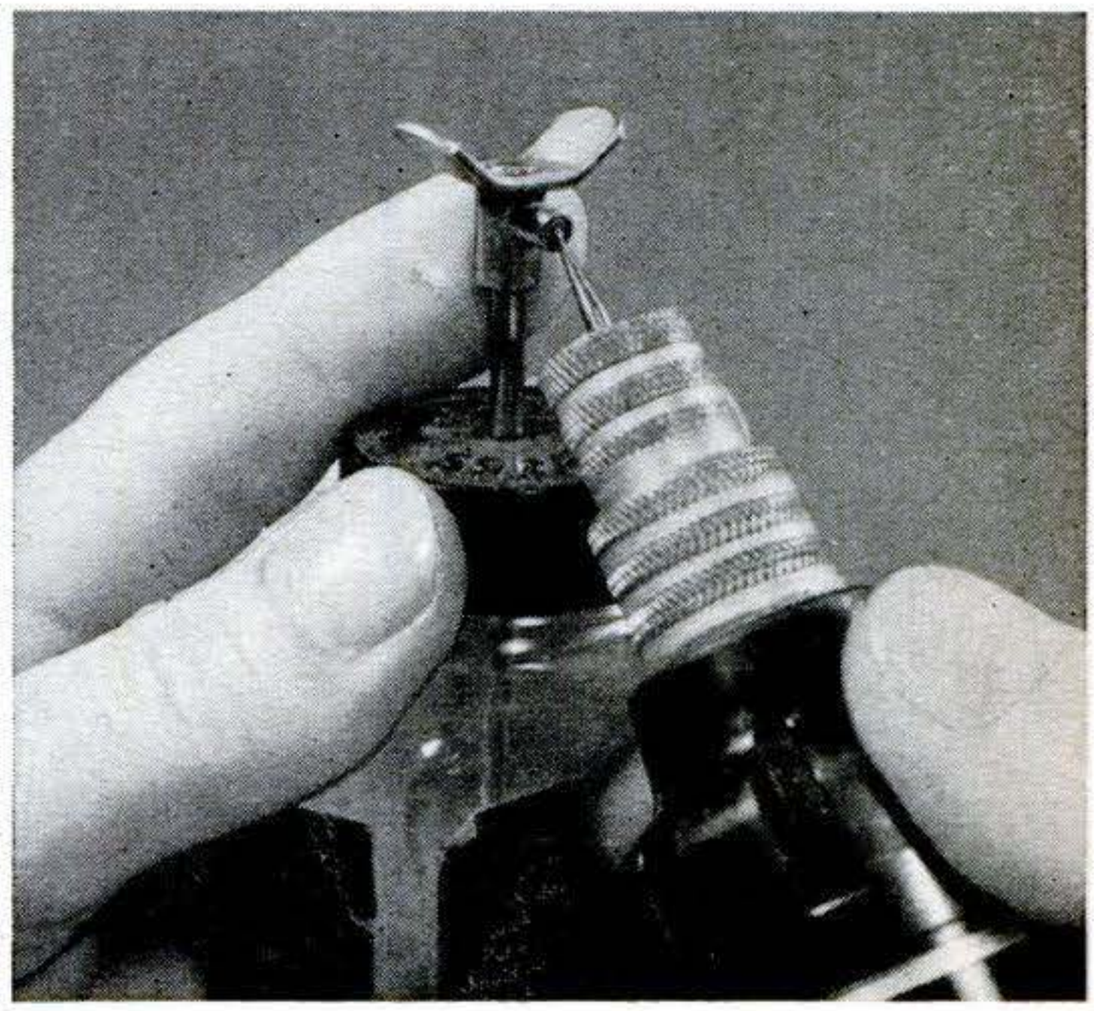
Scroll to Dress Up Screen Door Bent from Iron Rod

A SCROLL like this can do wonders for a plain screen door. Lay out the design full size on wrapping paper and bend up ¼" iron rod. Coil the ends around pipes of about the right size. Drill nail holes where the scrolls meet the door. Scroll-saw the gull from sheet metal and rivet it to the rod. This scroll is painted white with black dabs at the bird's wing tips.—*Hi Sibley, Nuevo, Calif.*



Awning Strip Diverts Rain

I STOPPED rain from splashing down through the small slit between the top edge of the awning and the house by covering the gap with a strip of one-by-three. Long screws fasten the one-by-three to the siding at a slant so it will shed water. Calking and a coat of paint complete the job.—*Howard McEntee, Ridgewood, N. J.*



Spray Bottle Dispenses Soap

YOU can make an effective liquid-soap dispenser from an ordinary window-spray bottle. Enlarge the spray opening with a small drill or burr. Angle the enlarged hole so the soap will squirt down rather than straight out. To make liquid soap, dissolve chips of Castile soap in warm water.—*Ken Murray, Colon, Mich.*

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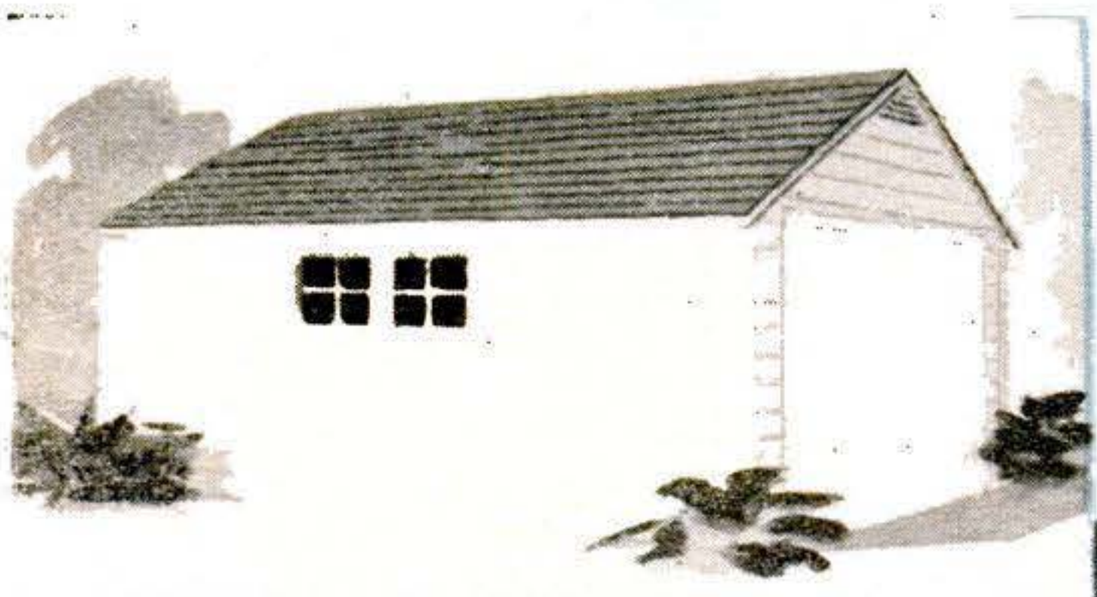
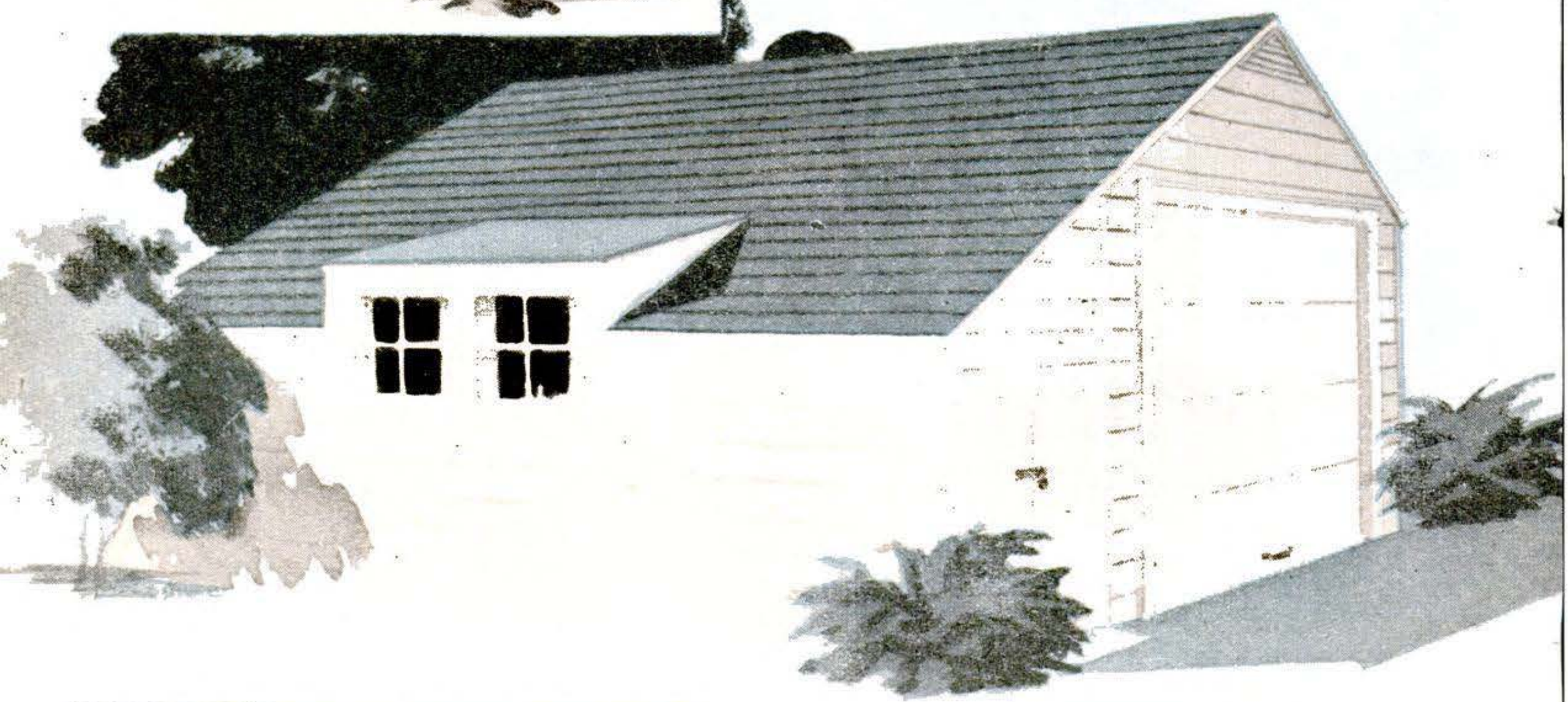
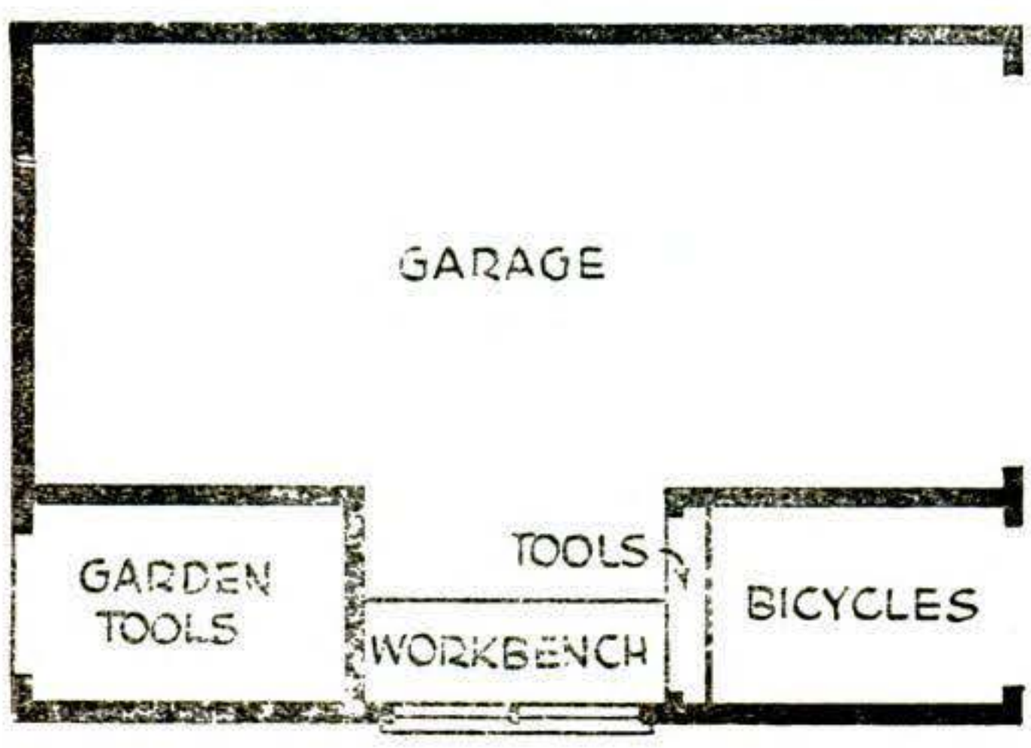
Look Outdoors for Your Storage Space

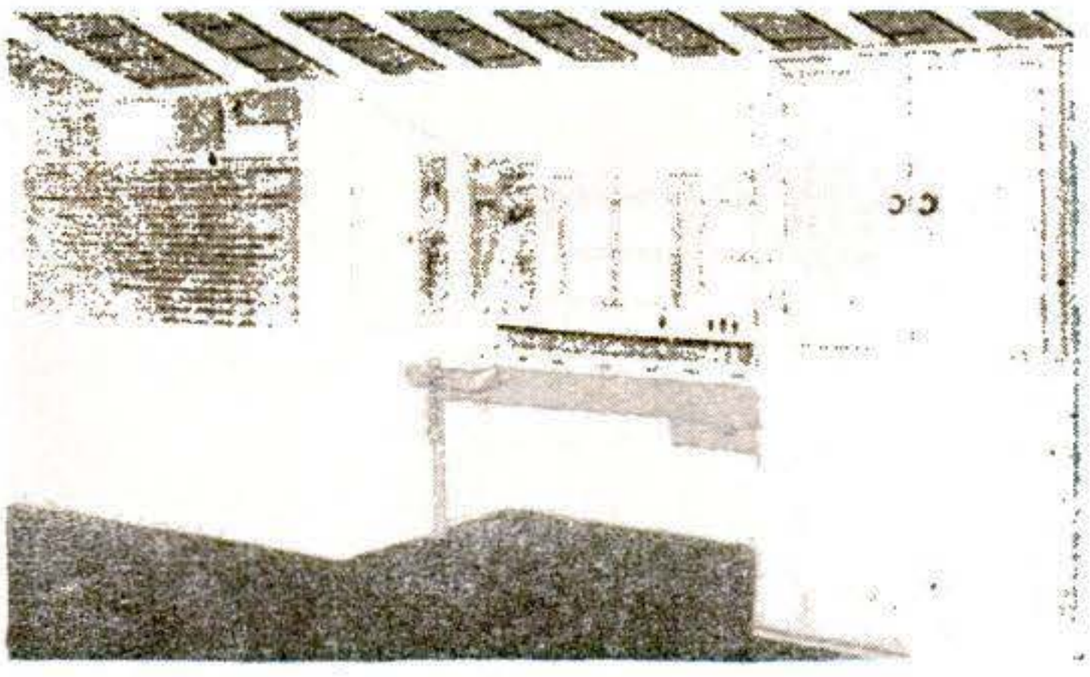
When your utility closets begin to resemble Fibber McGee's it's time to think of all the room going to waste in the yard. Here are four basic ideas for putting it to good use.



CONVERSION JOB. A garage (left) can be stretched as below to make room for workbench, tools, garden implements and even a couple of bicycles. Same type of framing shown on opposite page should be used. Remove shingles and sheathing to expose rafters. Spike extension rafters to sides of garage rafters, resting extension rafters on plate of garage wall and on plate of new wall. Carry dormer framing to garage plate.







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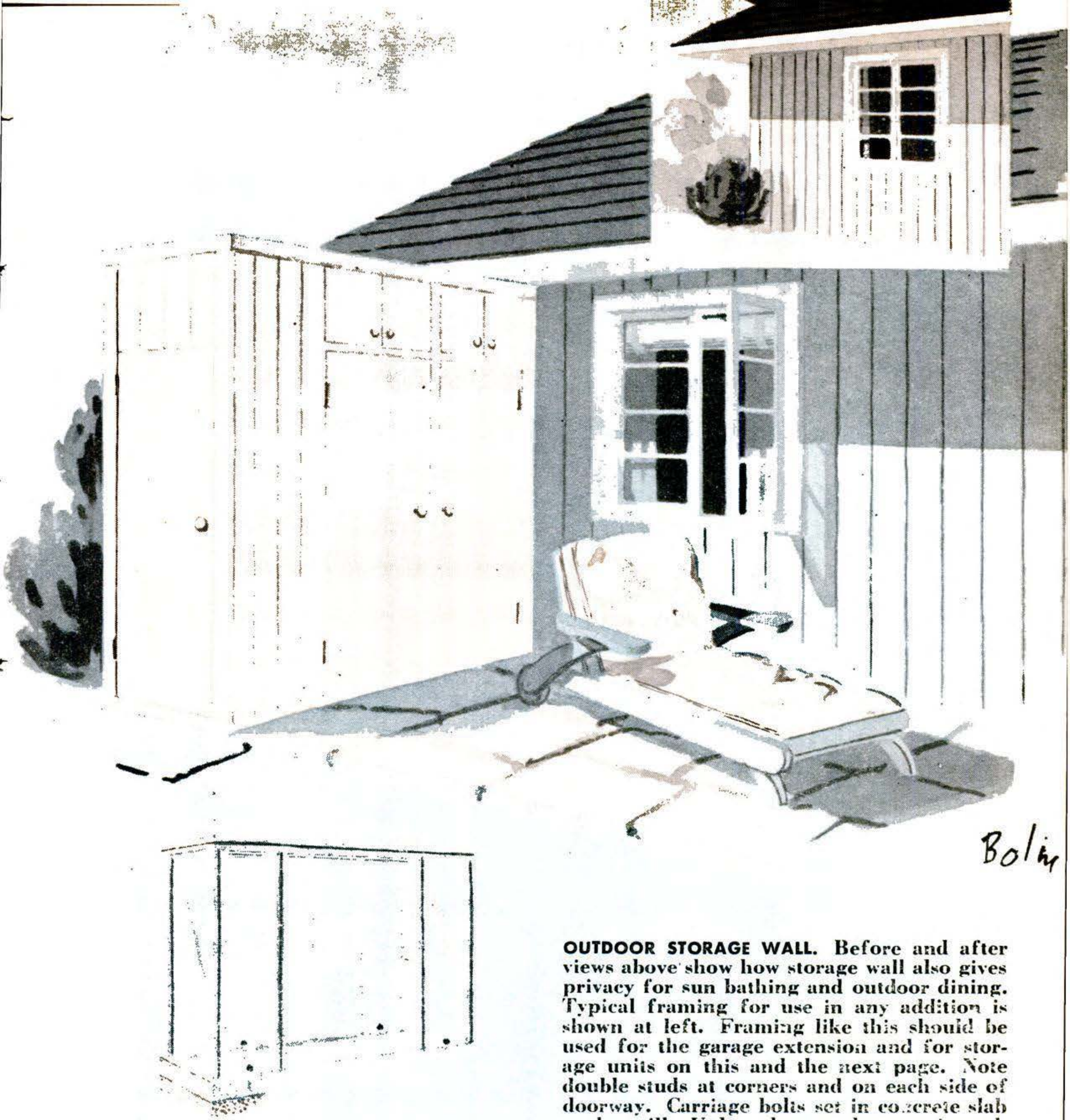

OUTDOOR STORAGE WALL. Before and after views above show how storage wall also gives privacy for sun bathing and outdoor dining. Typical framing for use in any addition is shown at left. Framing like this should be used for the garage extension and for storage units on this and the next page. Note double studs at corners and on each side of doorway. Carriage bolts set in concrete slab anchor sill. Unless there is doorway in end, nail on diagonal one-by-fours as bracing.

MOST garages bulge with everything from garden tools to bicycles and old pails of paint—in addition to the family car, of course. Getting from the garage door to the front seat of the car means stumbling through a junior-size obstacle course.

When there's no more storage space inside, the only place to move is outside. You may find it easy to stretch your garage as shown on the opposite page, or you can build storage closets like those on this and the next page.

In every case, these storage closets offer more than just storage. Besides providing a place to park storm windows, screens, sleds, lawn mower or garden furniture, they will pay an extra dividend in privacy, added workbench space or an enclosed yard.

If you need extra storage room, you almost certainly need it for certain specific things. So it's good sense to make your plans with these needs in mind. Check the number, sizes and shapes of the articles. Think about their accessibility in terms of

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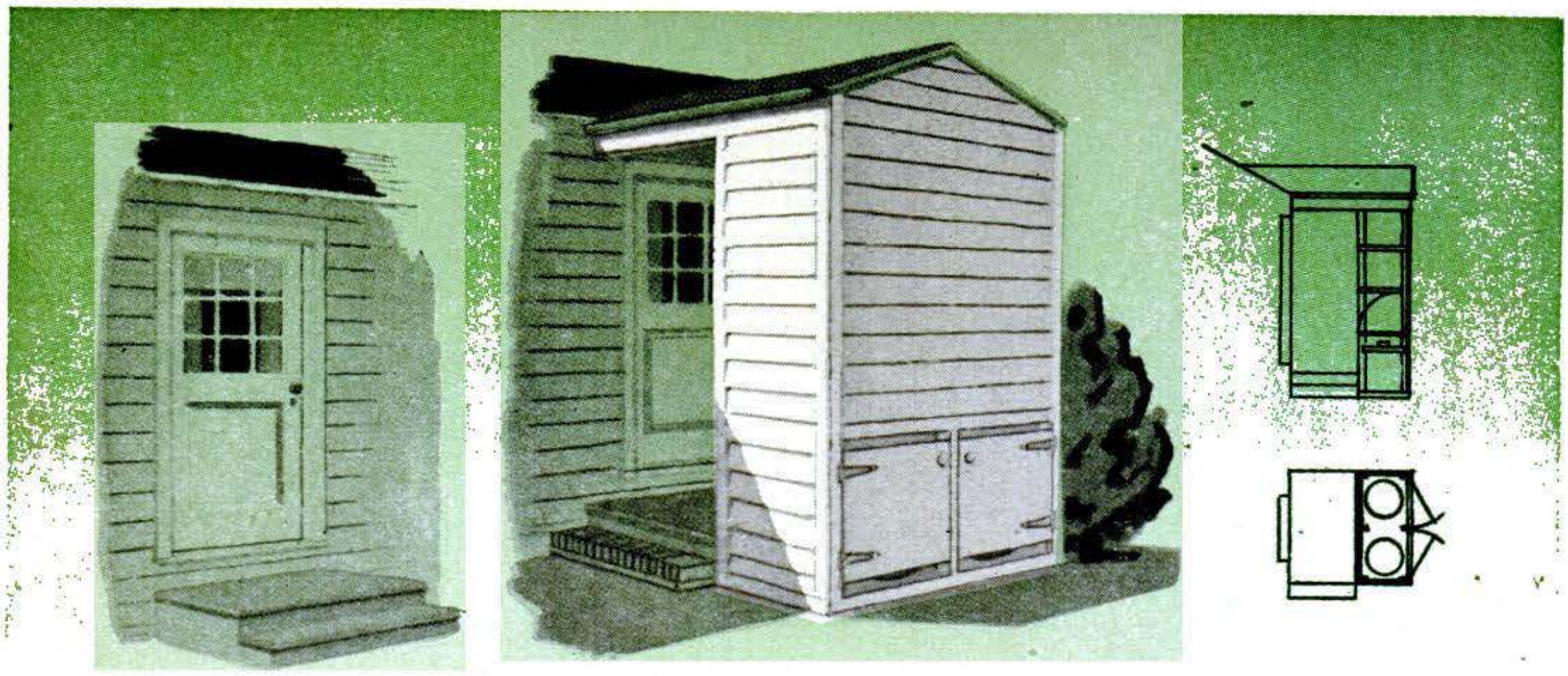


SHELTER PLUS STORAGE. Privacy and protection from weather are provided by this combination storage-shelter unit. Garbage-can section is accessible from both sides of unit: lids can be reached from inside to put garbage in without leaving shelter; cans may be removed through double doors on outside. Shelves above hold milk and other deliveries.

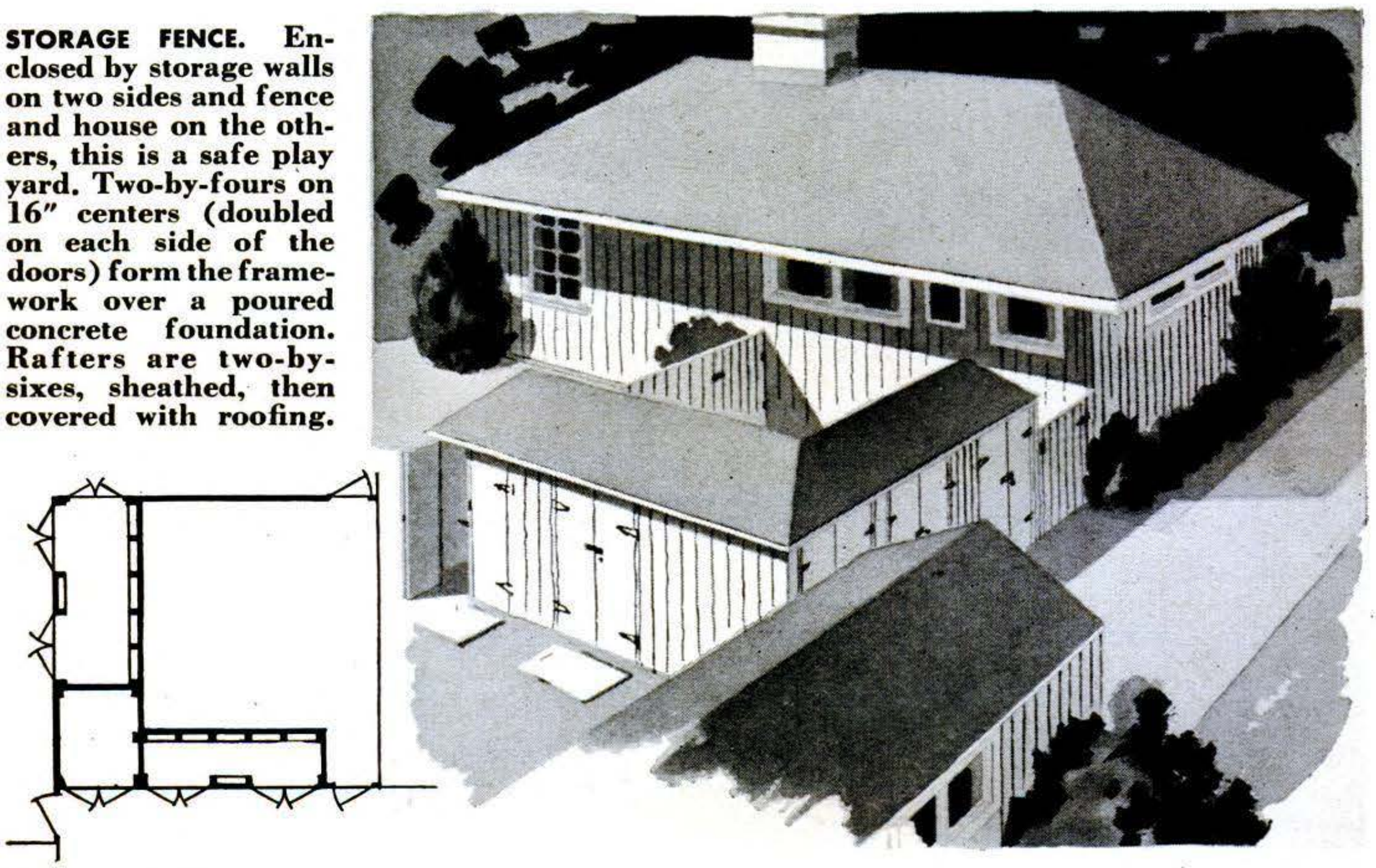
their usage, and who will use them. For example, tricycles and bicycles are in almost daily use. They should be placed more conveniently than, say, the lawn mower, which is used only about once a week.

Another good idea is to use existing garage or house walls whenever possible. This will cut construction costs and make it easier to fit additions into the house design.

The construction of these units is relatively simple. First pour a 6″ concrete slab over 4″ to 6″ of cinders. Set carriage bolts in the wet concrete. Anchor a sill with the carriage bolts. Erect two-by-four studs on 16″ centers and put a two-by-four top plate on the studs. Rafters can be two-by-fours for the narrower jobs; two-by-sixes for roofs with longer spans.

Before starting any building make sure zoning rules permit adding to your house, and get a permit if necessary.—*Carl T. Sigman and William J. Ward Jr., N. Y. C.*

STORAGE FENCE. Enclosed by storage walls on two sides and fence and house on the others, this is a safe play yard. Two-by-fours on 16″ centers (doubled on each side of the doors) form the framework over a poured concrete foundation. Rafters are two-by-sixes, sheathed, then covered with roofing.



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Hidden Fuses Protect TV Sets

One bad part can damage others. Fuses turn off the juice before this happens.

FUSES and circuit breakers are used in many TV sets to protect expensive parts, keep house fuses from blowing when something goes wrong, and prevent overheating that may cause fires. Not all sets have fuses, however, and those that do may use them differently.

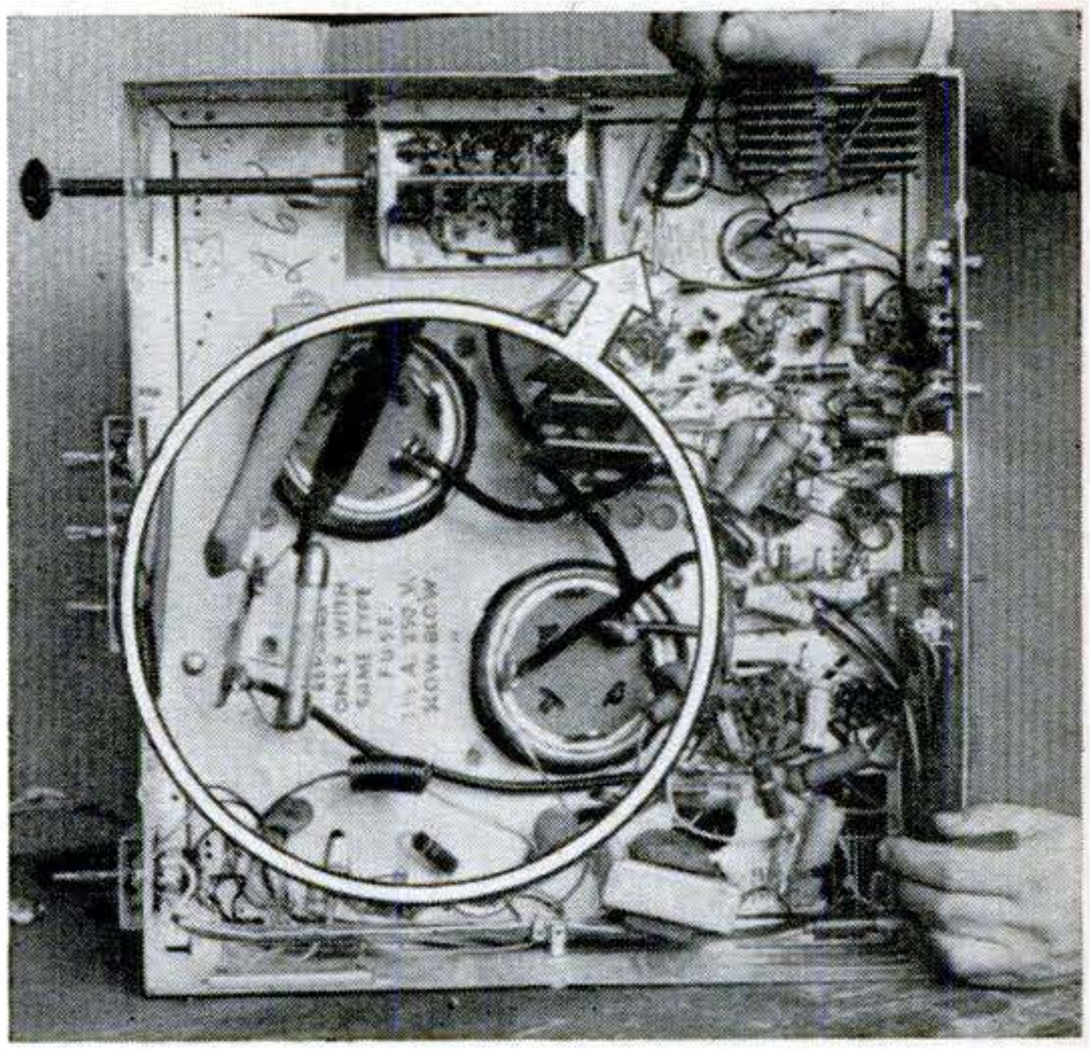
In a few models they are put where you can check them quickly. In many others they are hidden on or under the chassis. These can mislead you and turn what should be a five-minute service job into a costly repair-shop trip.

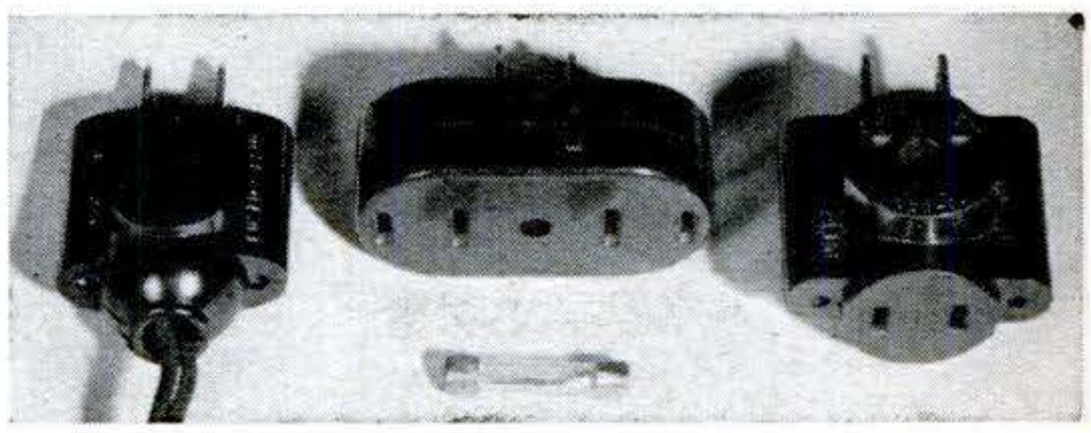
Check your set before calling in a professional, and try to find out whether it has fuses, where they are and what they do. The best way to do this is to study the manufacturer's service notes. Any time you have the chassis out, mark fuse locations. It is easy to recognize the slender glass tubes that are clipped in black spring holders, but don't overlook the ones with soldered-in pigtails that may be hidden under other parts.

Power circuits in some sets have slow-blowing fuses that can withstand surges in line voltage and momentary high currents occurring during warm-up. They should be replaced with fuses of the same type.

High-voltage circuits are often fused independently. The fuse is rated at a fraction of an ampere. When it opens, the picture tube goes completely dark but sound is not affected.

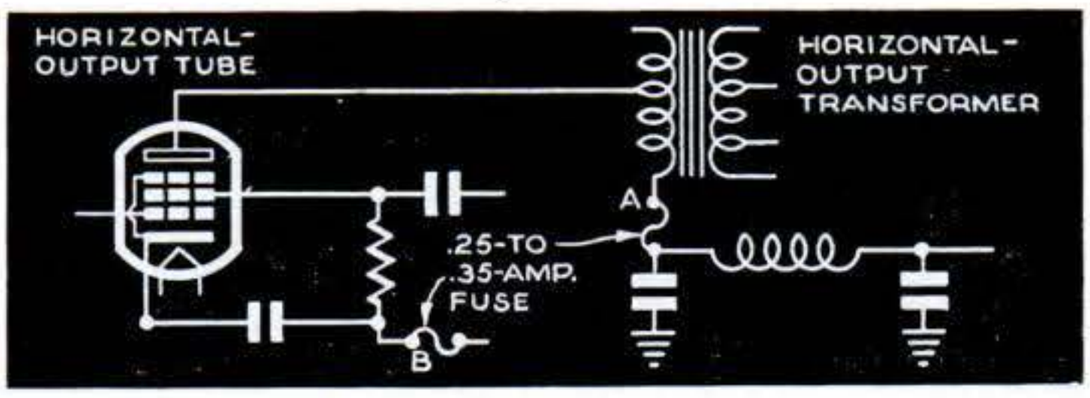
A blown fuse or a tripped circuit breaker is a sign of trouble. Oddly enough, it may not reappear when the fuse is replaced or the breaker is reset. Therefore allow yourself one new fuse or one push on the breaker. If it kicks out again, call in your serviceman; the set needs expert attention.



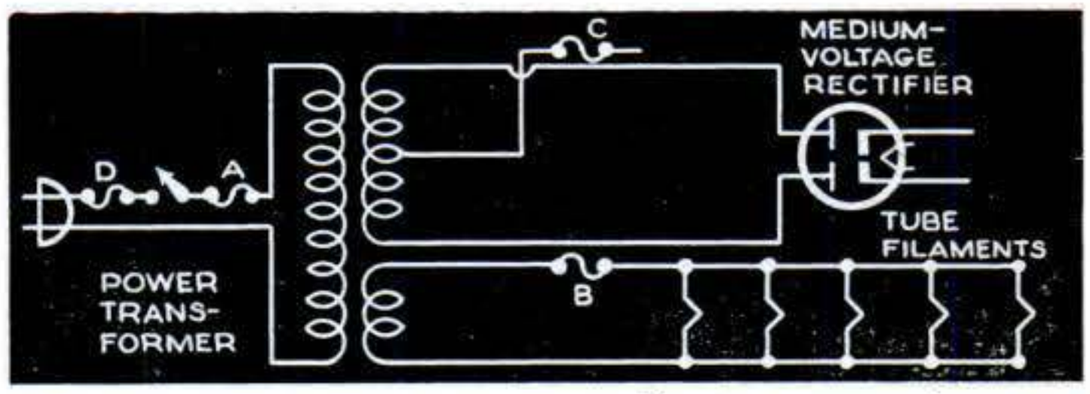


FUSED PLUG (left) and two types of outlet adapters can be used to protect unfused sets. Top: fuses are often soldered under chassis.

You can fuse the power circuit of your set if it has no built-in protection. Fused plugs and outlet adapters like those above cost less than a dollar. The plug replaces the one on the receiver's line cord; the adapter just plugs in between the set and wall outlet. They use auto-type fuses; the five-ampere size is fine for any set. In case of trouble it will blow before the 15-ampere house fuse even gets warm.—*Robert Hertzberg, Jackson Heights, N. Y.*



HIGH-VOLTAGE CIRCUITS are fused in some sets to protect horizontal-output transformer. Fuse may be in series with transformer (A) or tube (B) and located in or under high-voltage doghouse. Sometimes both tube and fuse blow together and must be replaced.



POWER-CIRCUIT FUSE may be in transformer primary (A), filament winding (B) or medium-voltage secondary (C). First two disable set completely; third may leave some or all tubes lit but kills picture and sound. Fused plugs or adapters (D) act same as (A).

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What Makes Jets Fly?

Their engines don't push against the air. Rockets even fly best in no air at all. Why? It's the same reason guns kick hard but bazookas don't kick at all. These simple stunts will show you.

By Kenneth M. Swezey

THROWING A PILLOW may seem to have little connection with the F-90 jet fighter at the top of the page, but in this case the same scientific principle is involved. The pretty girl about to do the heaving is seated on a revolving stool with her feet clear of the floor. If she throws the pillow hard, the stool will turn her in the opposite direction from which she throws. This demonstrates Newton's Third Law of Motion—for every action there is an equal and opposite reaction. When the girl pushes the pillow forward, it pushes her backward with equal force. In a jet plane—and in a rocket, too—expanding gases escaping backward kick the plane or rocket forward with the same thrust that they exert to the rear.

But don't make the mistake of thinking that the gases push against the air at the rear. Jets need air to support their wings and to supply oxygen to burn their fuel, but air actually holds them back. Rockets, carrying their own oxygen, travel best where there is no air.

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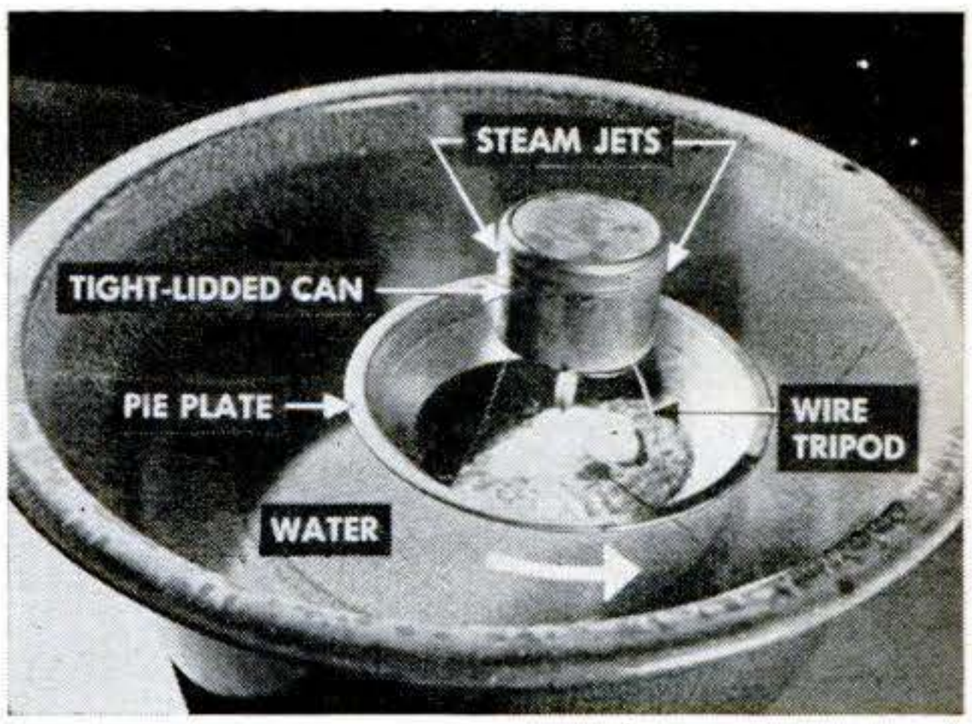
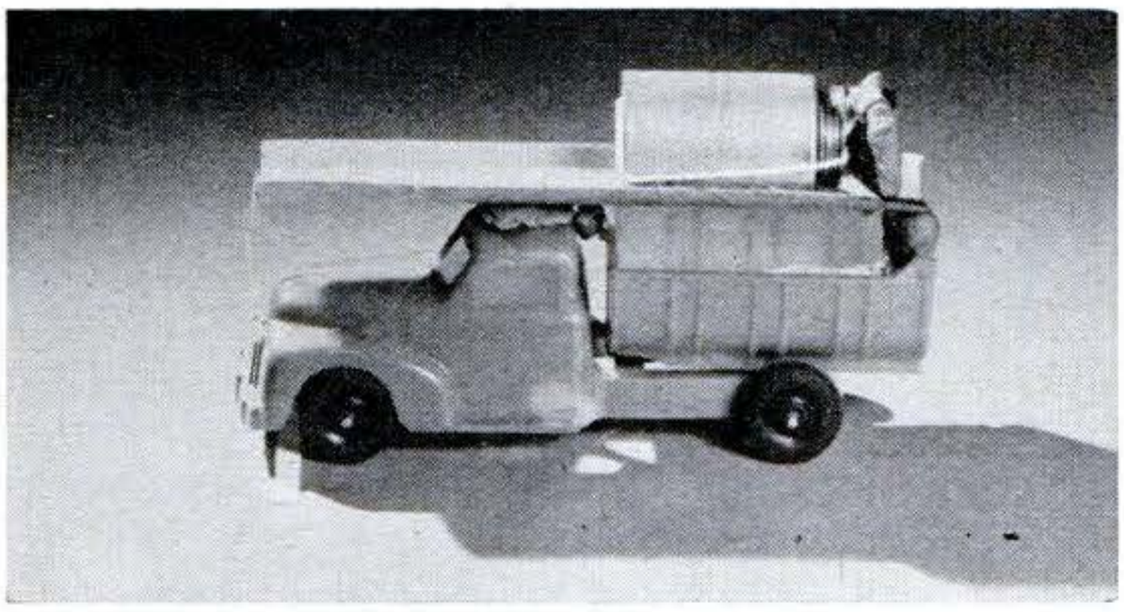
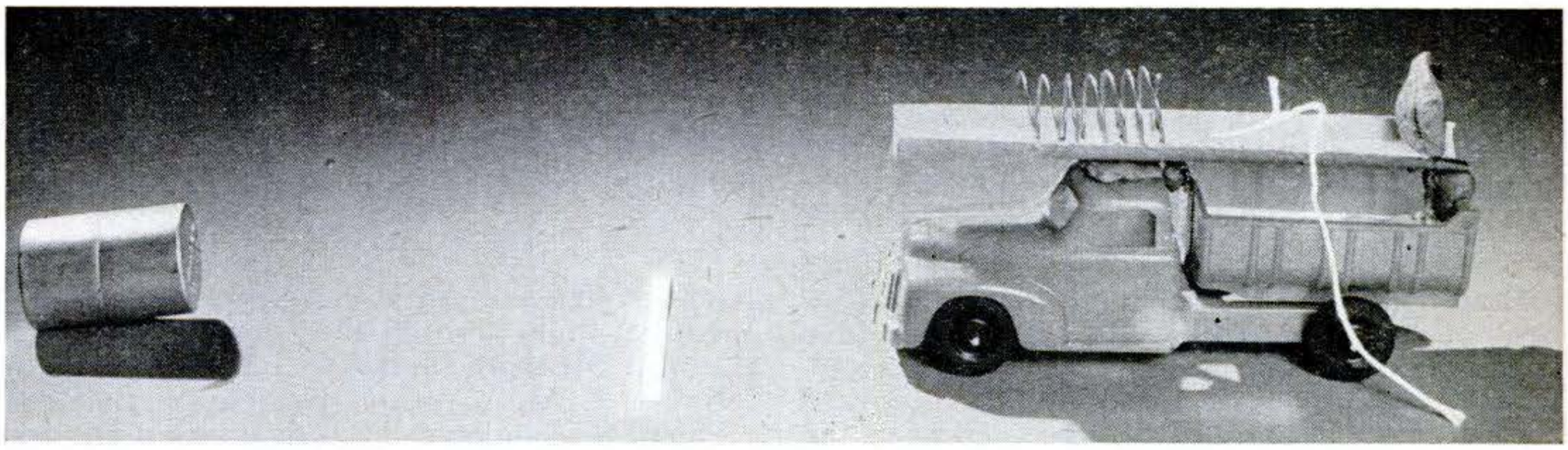
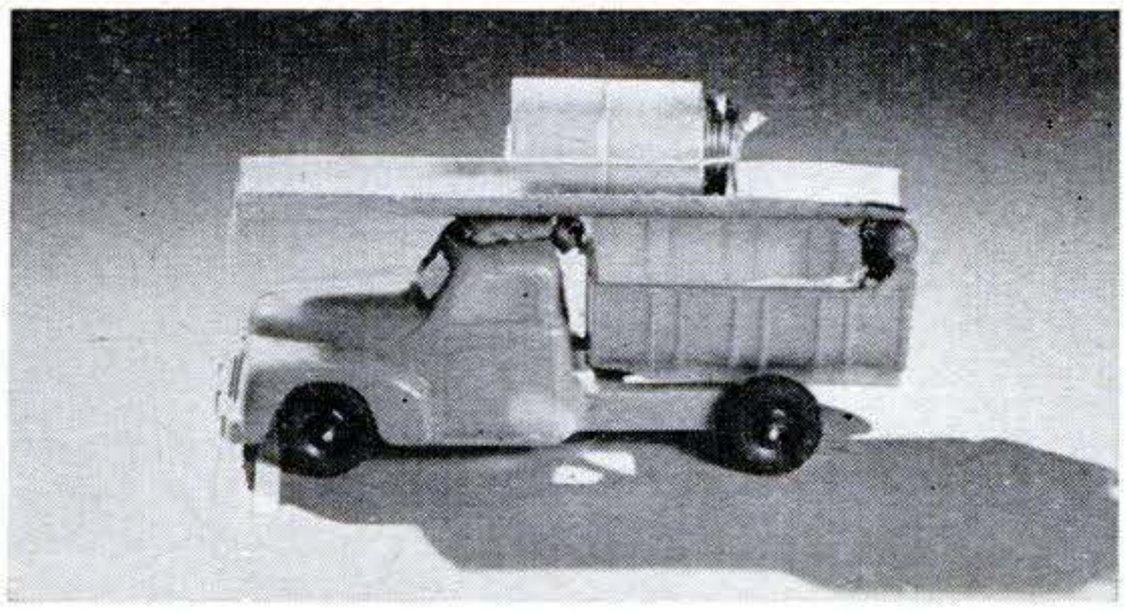
THE ANCIENTS KNEW THE PRINCIPLE behind jet propulsion. A toy steam engine devised by Hero of Alexandria 2,000 years ago was propelled by steam issuing from jets on opposite sides of a revolving globe. Here's how you can make a simplified working model. Form the tripod from coat-hanger wire. Punch two 1/16" holes on opposite sides, near the top of a can with a tight lid. With a nail, give the holes a sideways twist so they face in opposite directions at a tangent to the can. Put a little water in the can, set a lighted candle under it, and float the pie plate in a water-filled basin. When water in the can boils, steam issuing from the jet openings will cause the pie plate to spin in the water basin.



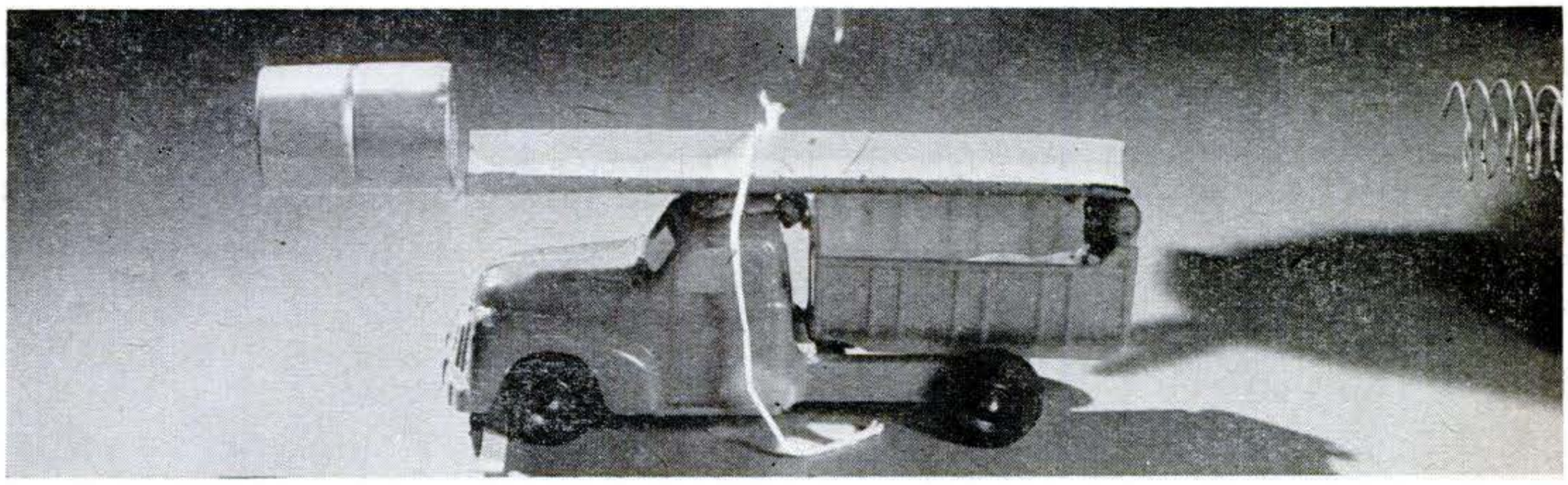


A GUN KICKS for the same reason that jets fly—because of action and reaction. To see this, tie a compression spring tightly against one end of a 35-mm. film can and tape a piece of mailing tube (cut lengthwise) on top of a toy car. Place can against a solid clay backstop and cut string with a razor blade. The spring (corresponding to exploding powder in a gun) will push the projectile (the can) forward. Spring also pushes back on the backstop, or gun breach. This makes car roll back (below)—and gun recoil.





BAZOOKA DOESN'T KICK—and the reason again is found in Newton's law. Compress and tie your spring once more to the film can, but remove the backstop from the tube. When you now cut the string, the projectile goes forward while the spring jumps back. The tube, now used as a bazooka, and the car stay put. Unlike guns, bazookas and other rocket launchers are merely guides for the projectile. Retreating gases absorb all the recoil.



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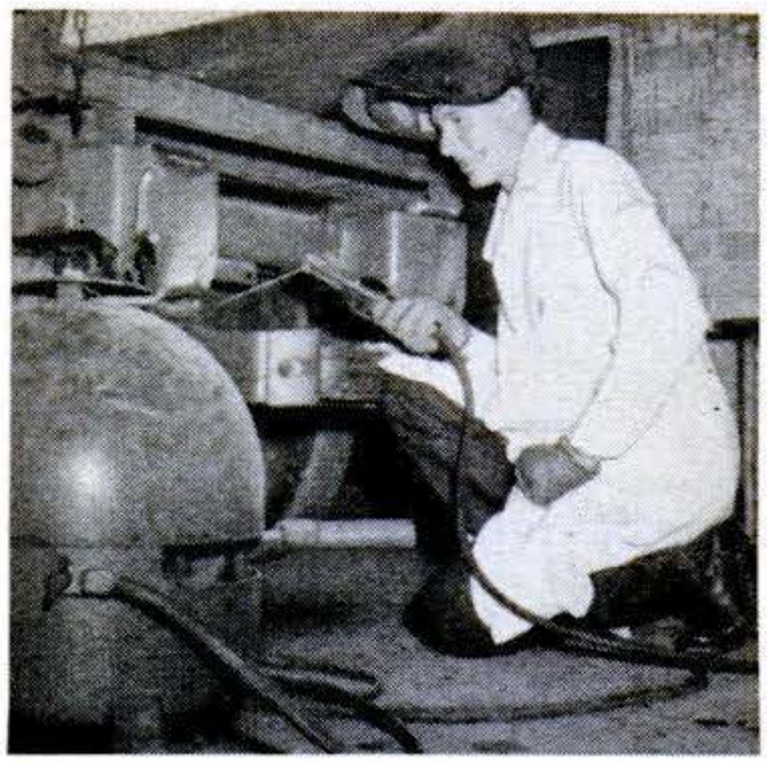
How Young Welders Win Prizes

Building everything from giant trailers to complex tools, farm kids show that they can lay a bead with the best.



YOUTHFUL WELDER—Bill Abell of Phoenix, Ariz.—was typical contestant. He won Honorable Mention for trailer hitch.

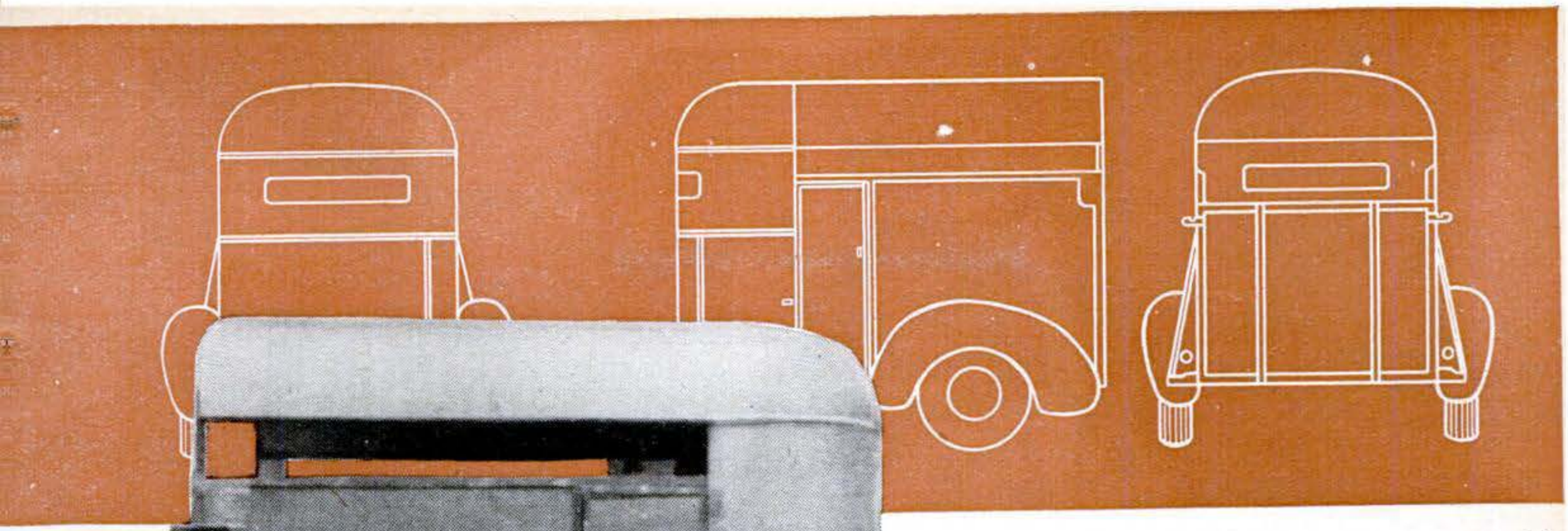
TAKE a bunch of farm boys with access to tools, dangle under their noses several thousand dollars in prizes for welding projects—and what do you get? These pictures—only a few of the prize winners—tell the story. Our future farmers will be as handy in the shop as in the fields.

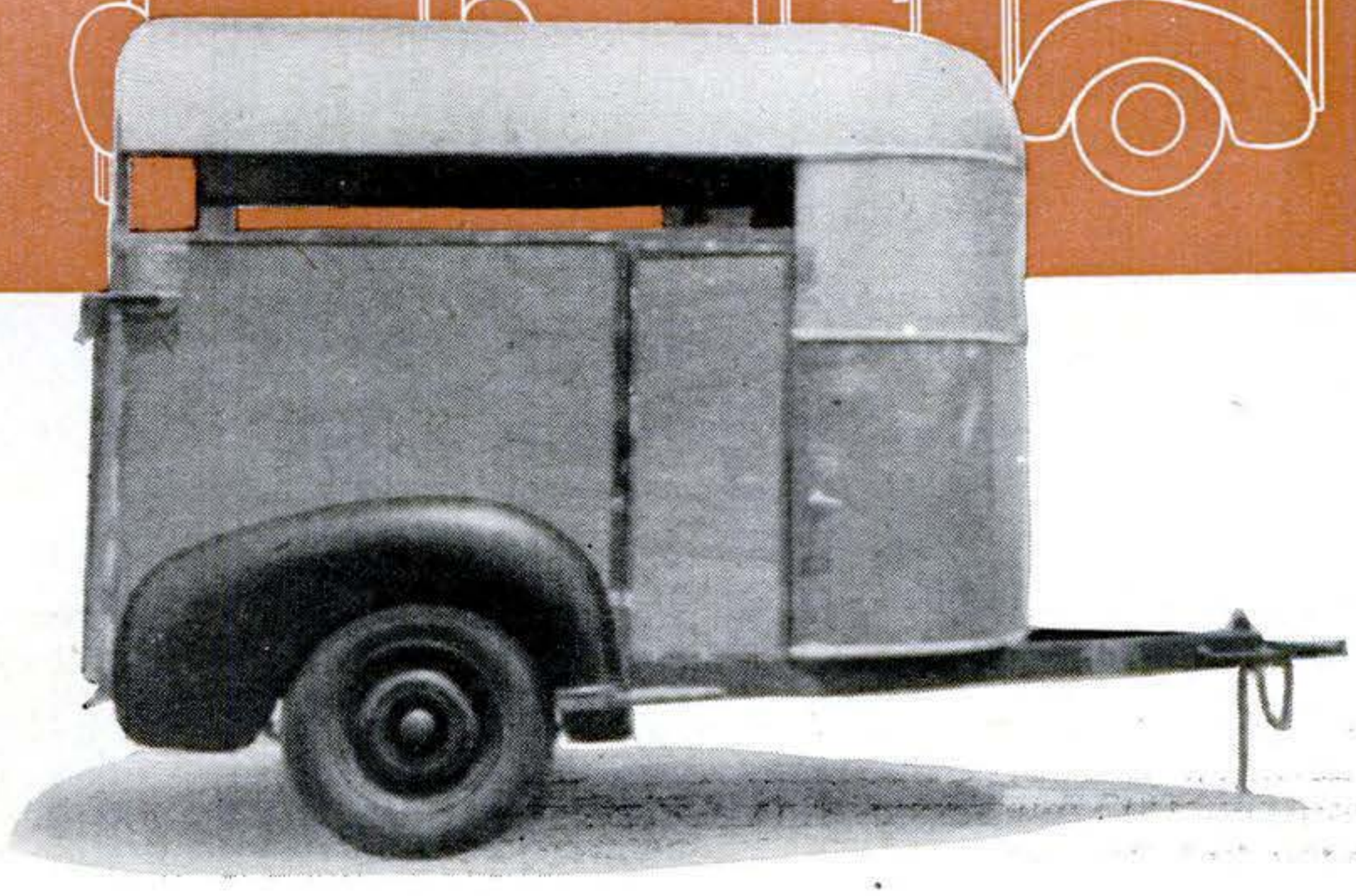
Everything from Western branding irons to grapples for Maine 'tater barrels showed up among the entries. Sponsored by the James F. Lincoln Arc Welding Foundation of Cleveland, the 1951 contest was limited to farm boys studying vocational agriculture in high school. They sent in a description of a farm project using arc welding. Prizes, totaling $5,000 for the boys and $2,000 for their schools, were awarded for clarity and completeness of the description, plus usefulness and safety of the project.

Lincoln's second contest closes in mid-June. This year, any farm boy going full time to high school is eligible.

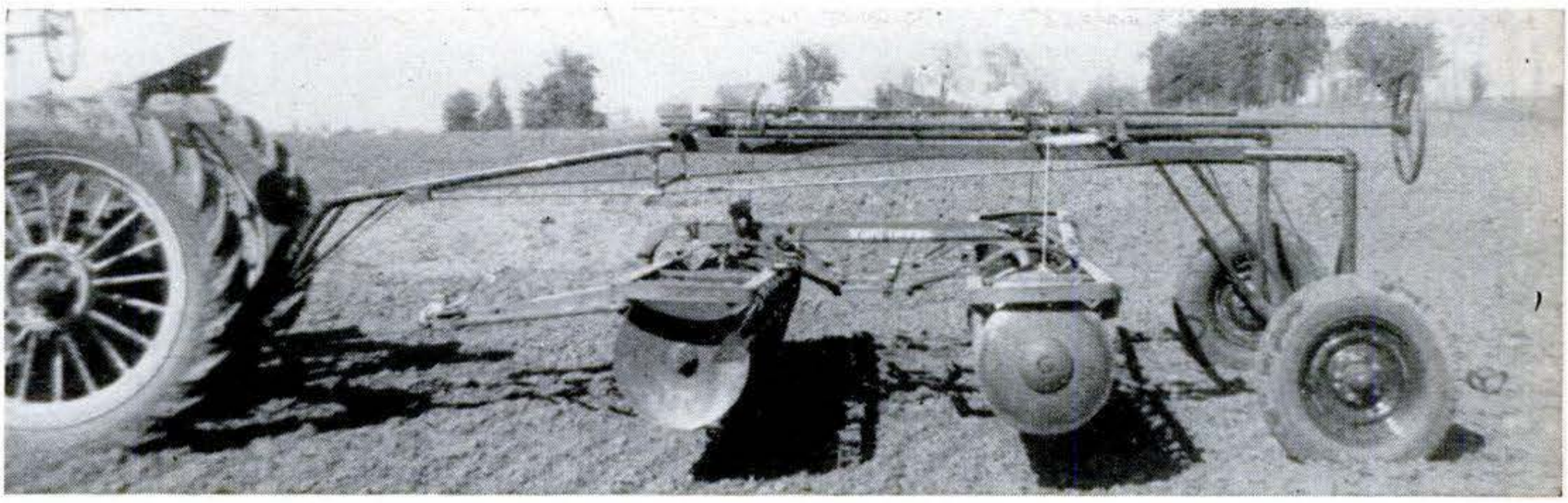
SECOND PRIZE—$400 each to the boy and his school—was won by this cattle squeeze, welded from pipe. (A squeeze holds cattle for branding or treating.) It was built by Raymond Labrucherie, who lives on big ranch near San Jose, Calif., goes to Live Oak Union High.

LIFT DERRICK, mounted on tractor, was part of project that won $100 Fourth Prizes for George McAlpin and his school, Highland High. McAlpin, who lives near Cowiche, Wash., welded derrick from heavy pipe, uses it on family farm to carry lumber, etc.



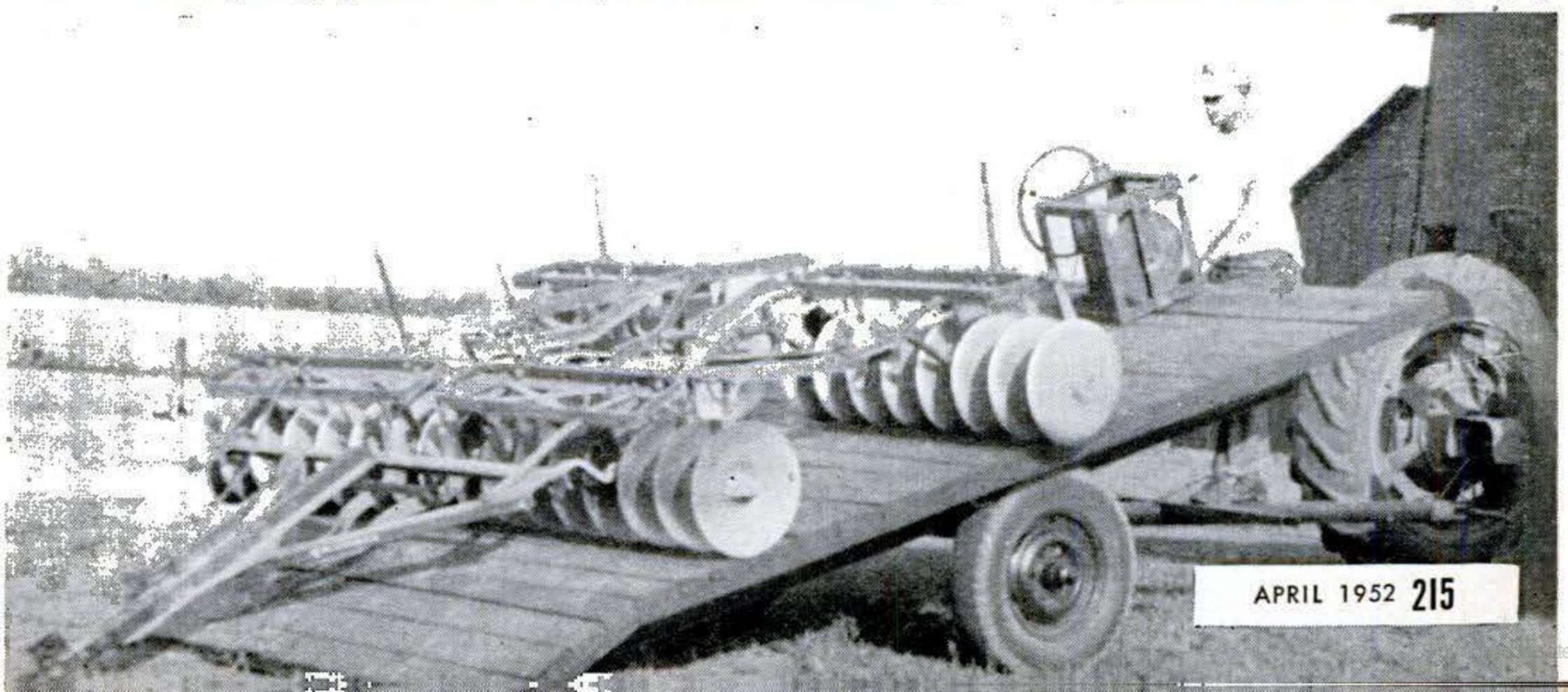


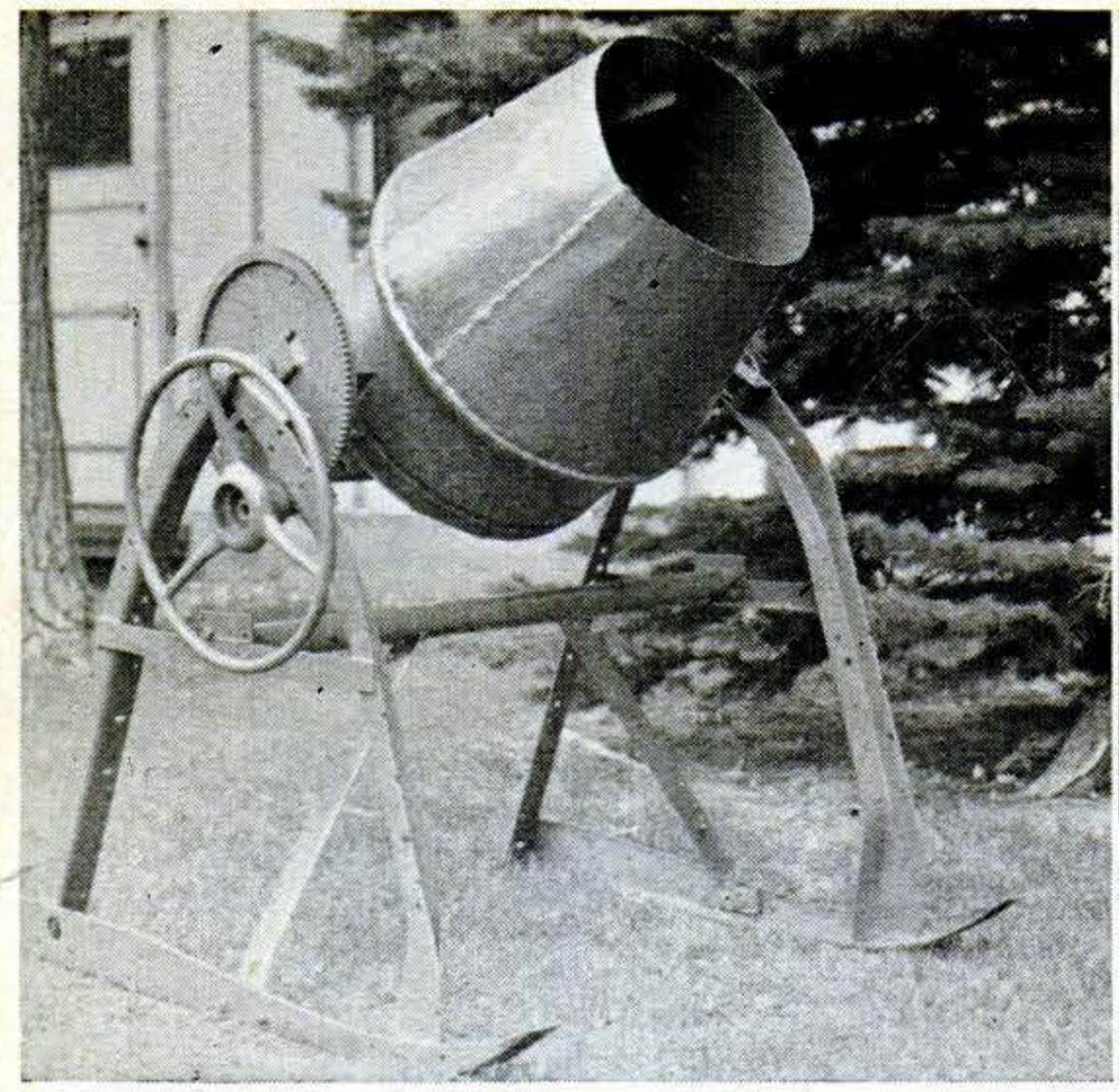
FIRST-PRIZE WINNER was this horse trailer. It brought $600 each to Stan Reifel of Ontario, Calif., and Chaffey Union High School. Stan thought of project because his father belongs to mounted-police group. Patterned after $1,000 commercial model, trailer cost $305. Frame is angle iron; sides, plywood; top and front, sheet metal; fenders came from Chevvy.



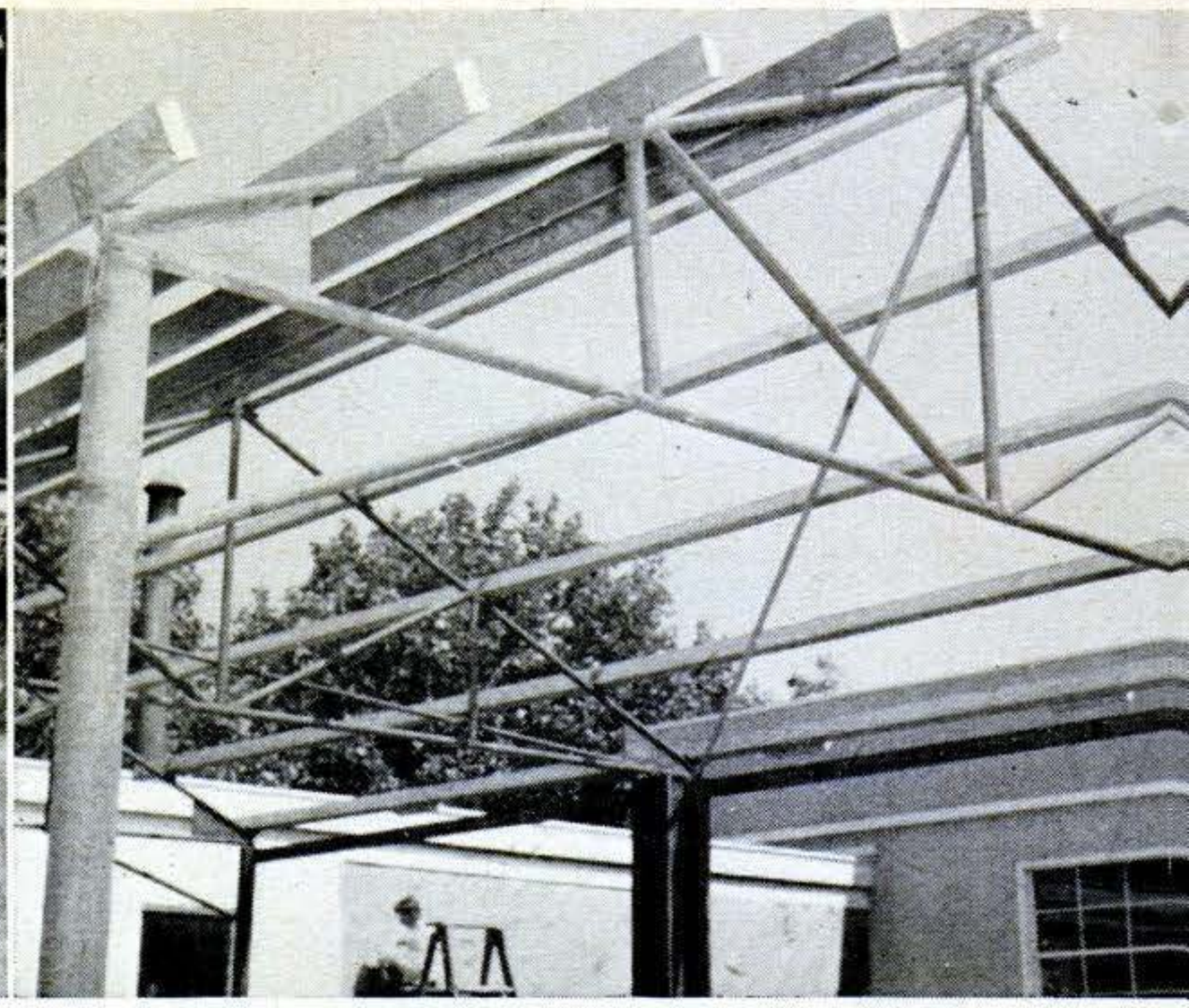
IMPLEMENT CARRIER, a $100 Fourth Prize winner, was designed by 17-year-old Dick Stremmel to carry machinery between tracts of family's 170-acre farm near Farmington, Ill. Welded from pipe and steel rod, carrier is swung over load, hitched behind tractor. After load is fastened on, hand winch lifts it. Load above is disk harrow weighing nearly a ton.

DUMP-TYPE FARM-MACHINERY TRAILER won Jack Seitzinger of Vincennes, Ind., one of two Third Prizes. Jack and his school, Lawrenceville Township High, each received $200. An I beam from old bridge was traded at machine shop for iron needed; another beam was cut up for frame members. Winch hauls loads up. *(Continued on next page)*

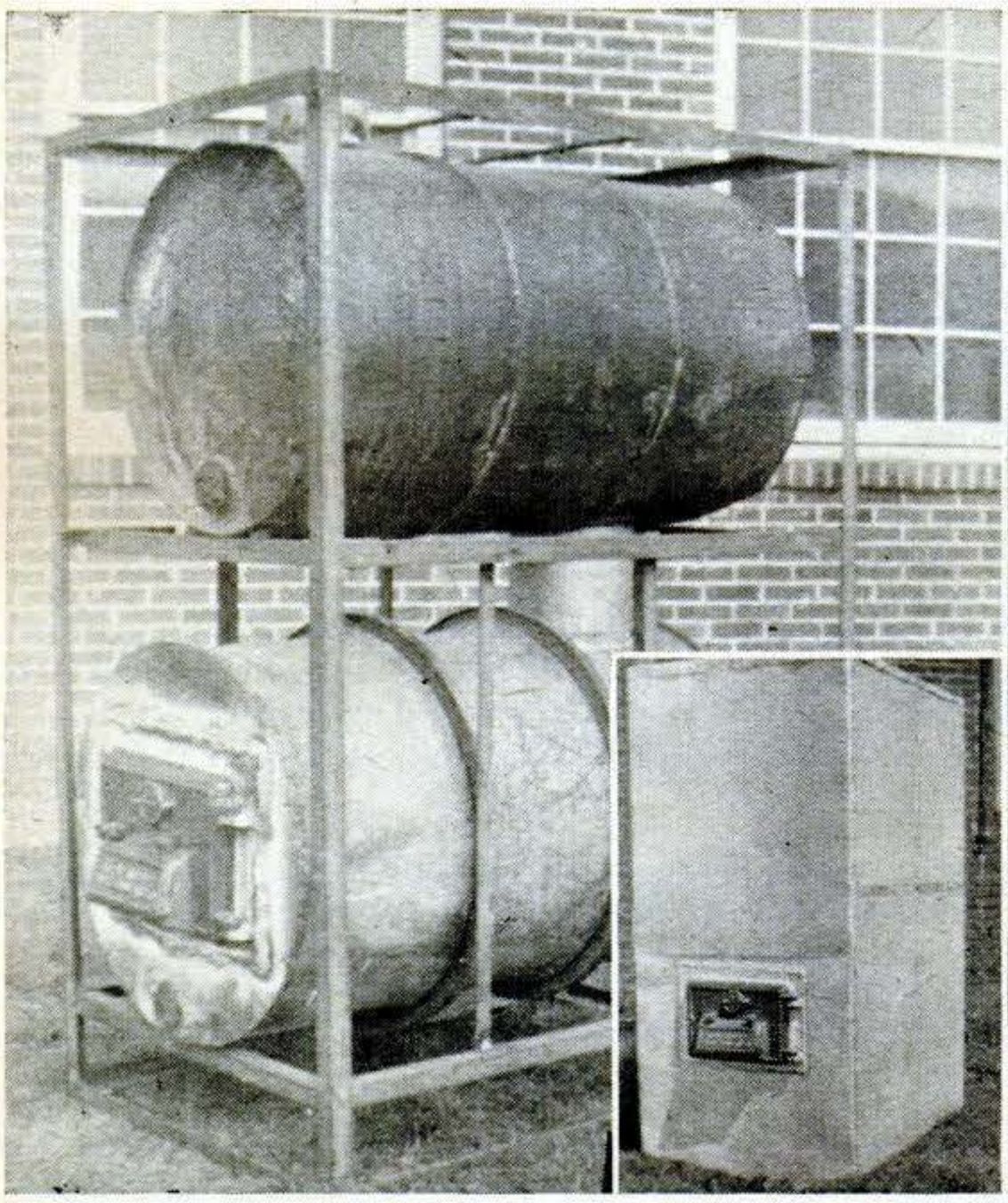




CEMENT MIXER won a $50 Fifth Prize for Edward Coulthard of Tie Siding, Wyo. Legs came from a Hudson frame, cradle from a Hudson front axle. Wheel is International steering wheel used with a Ford starter gear. The large gear is from Ford flywheel. Cone is bent from 1/8″ steel plate. A 1/3-horse electric motor gives 25 r.p.m. at cradle.



WELDED METAL FRAME for a blacksmith shop was submitted by Leo Tackeuchi, who lives near Fresno, Calif., and won a $25 Sixth Prize. The uprights are 3″ pipe and an 8″ I beam that will support a large drill press and trip hammer. Trusses are welded from 1″ pipe. Sides were later covered with galvanized sheets, fitted with sliding doors.



WOOD-BURNING FURNACE, which won Honorable Mention, was welded from two 50-gallon oil drums in an angle-iron frame, then covered (inset) with sheet metal and asbestos sheeting. Bottom drum is the firebox, half-lined with firebrick to prevent burning out. Top drum extracts more heat from combustion gases. Richard L. Kelley of Everson, Wash., a student at Mount Baker High, had family's wood lot in mind when he built it.

FOUR-WHEEL GARDEN TRACTOR won a $50 Fifth Prize for Martin W. Gundrum of Theresa, Wis., who got the idea while working on his family's 65-acre farm. The frame is welded from 3″ channel iron. The differential came from a Model A Ford, as did four-speed transmission and brake drum used as clutch. The reduction gear in steering mechanism and the front axle were salvaged from a Model T. Air-cooled engine delivers 2½ horsepower.

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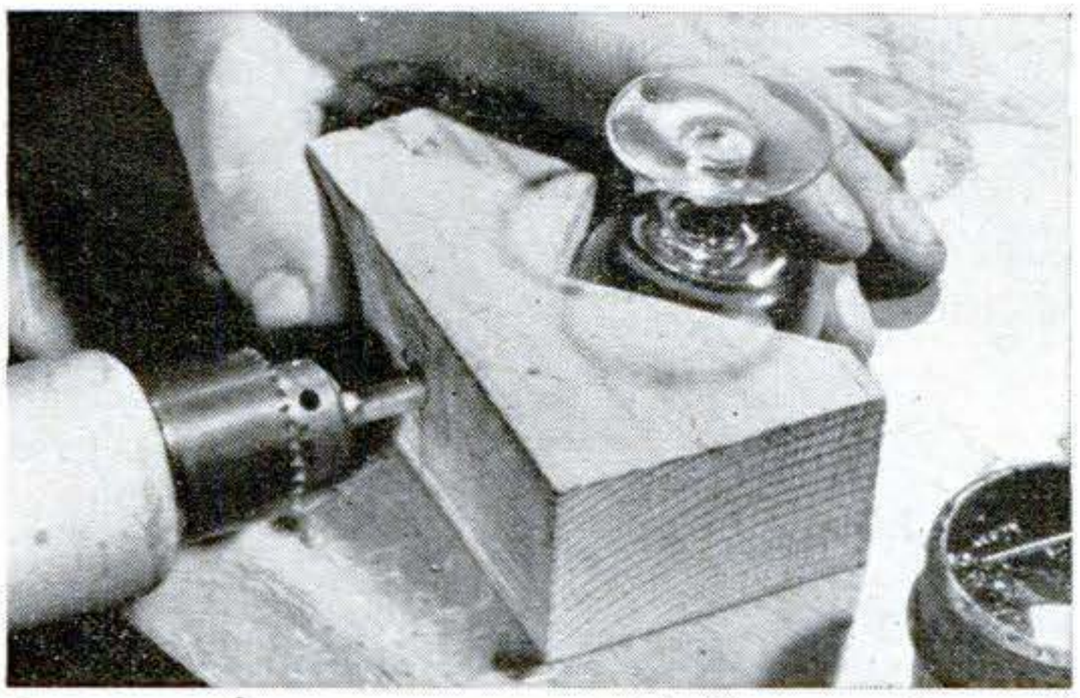
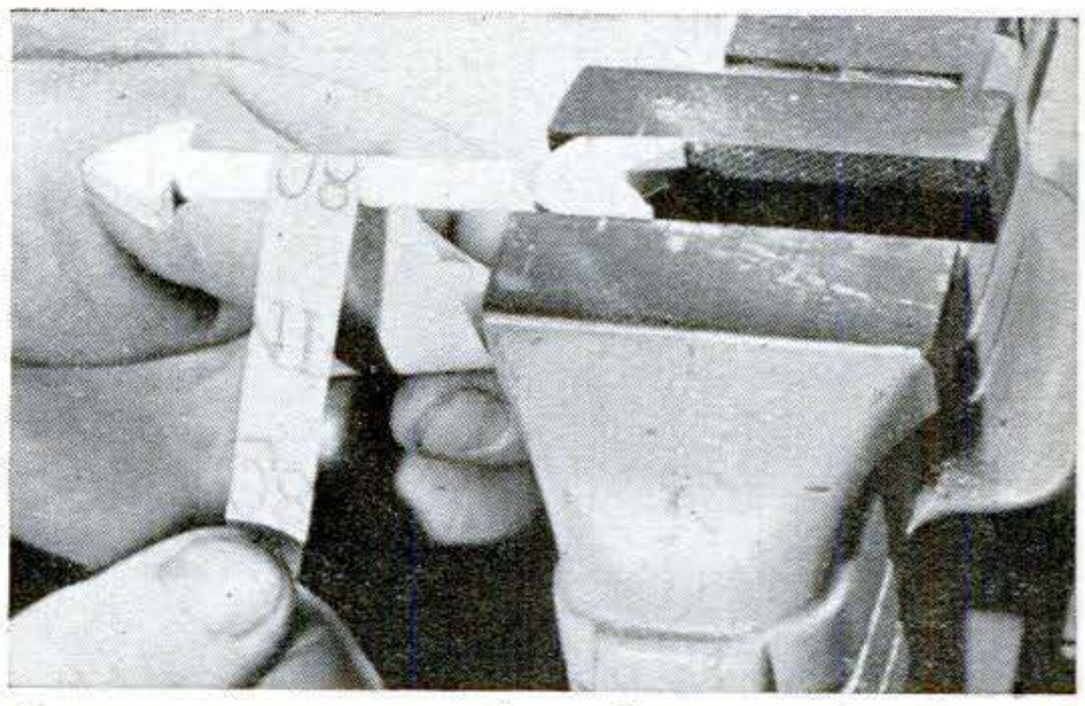
You, Too, Can Shoot Arrows Through Glass

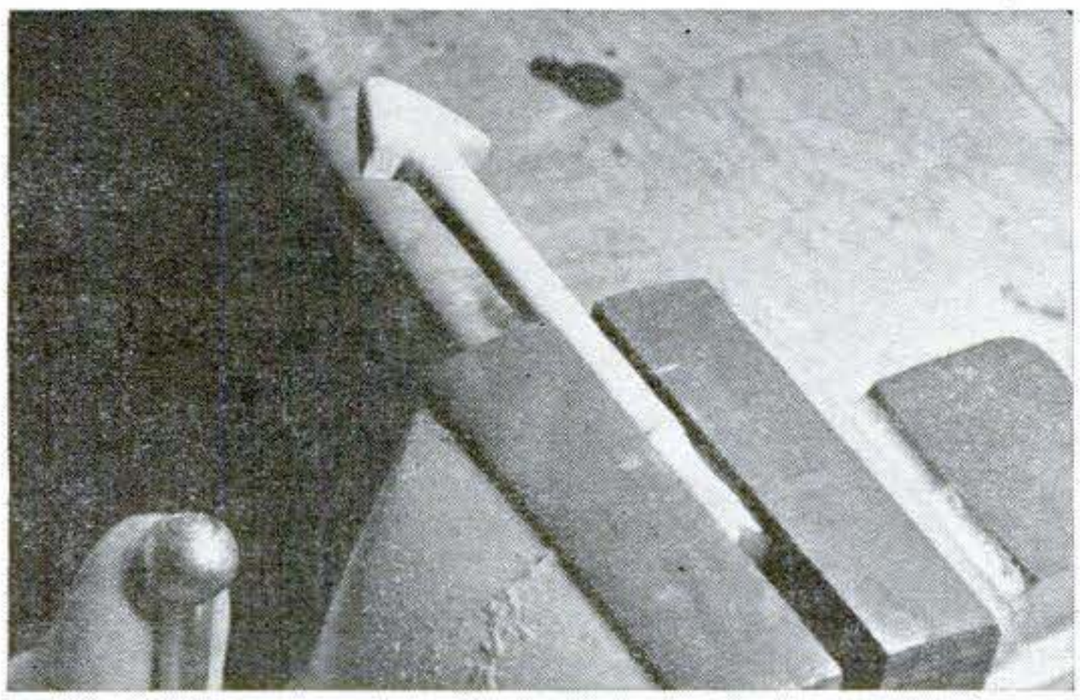
THIS eye-catching novelty will baffle your friends. They will say it's impossible to put a one-piece wooden arrow through holes too small for the head and tail. It's only a few minutes' work, however, when you know that wood has a "memory." You can vise-squeeze it to less than half thickness. When you wet it, it springs back.



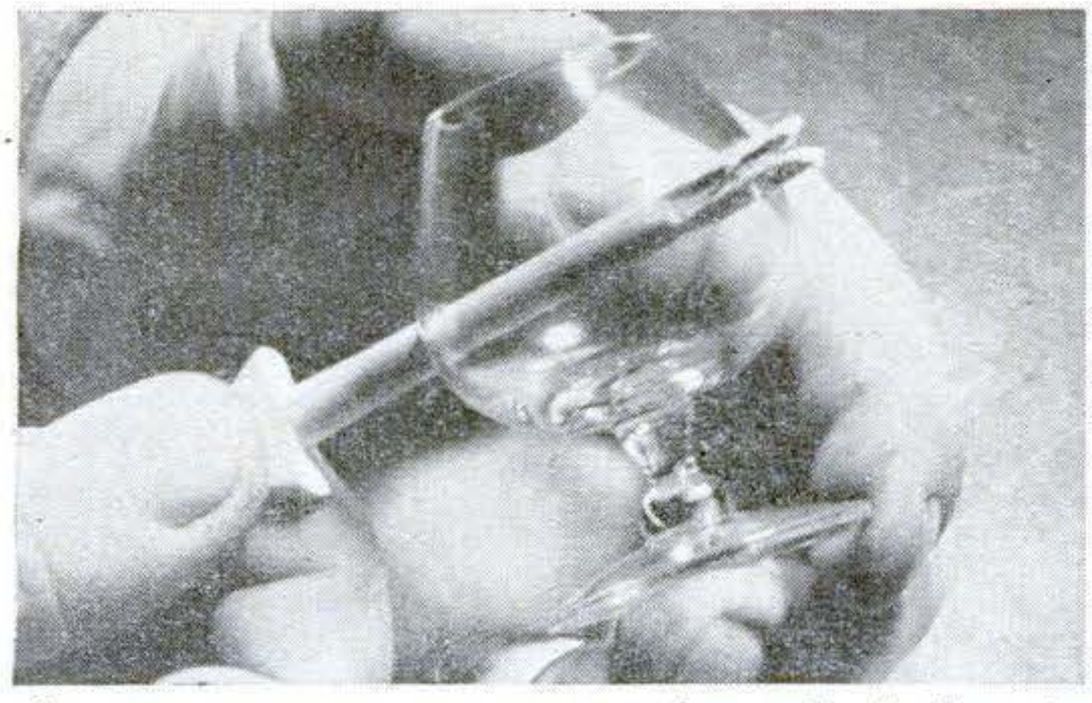
1 DRILL HOLES IN GLASS with brass tube and abrasive grit. V block steadies drill.



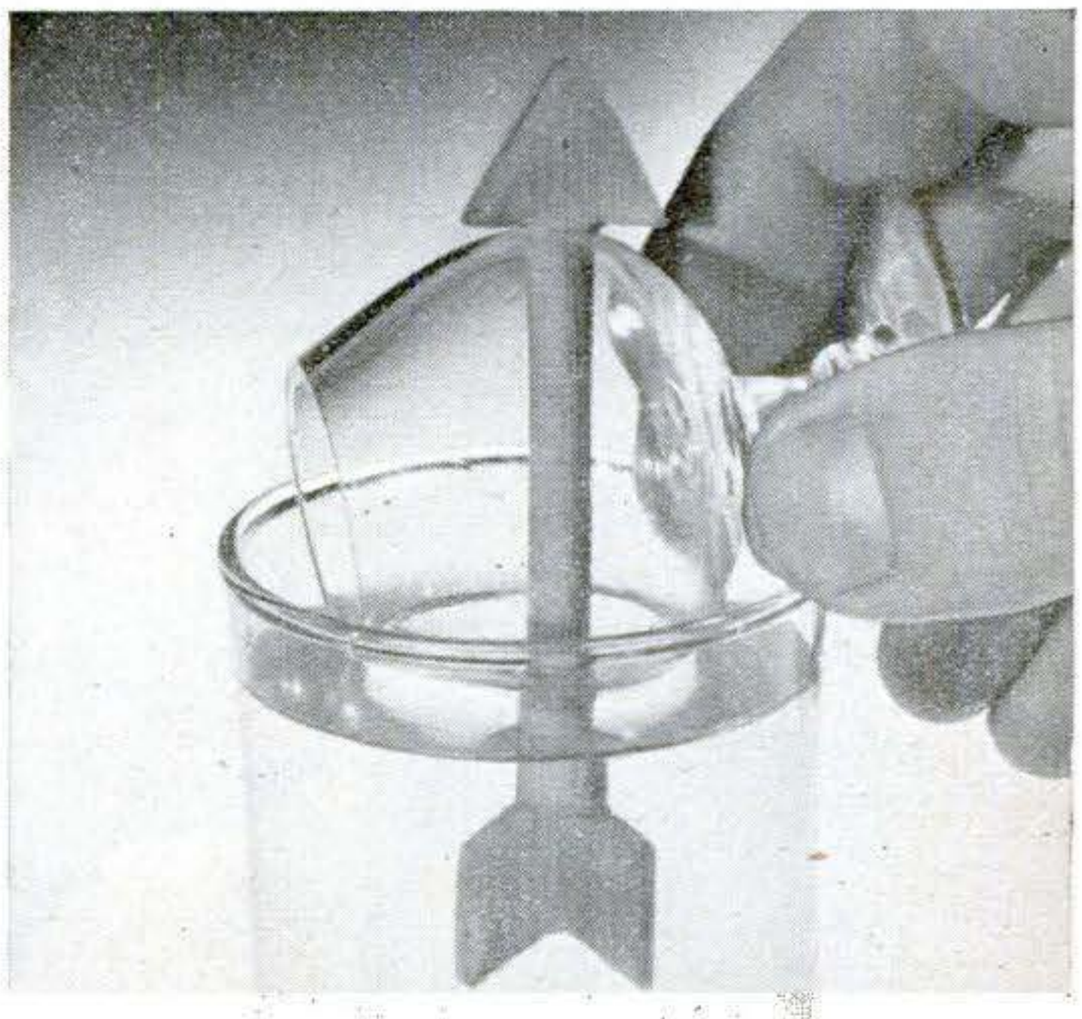
2 CARVE ARROW and sand it smooth. Round the spear and shaft but leave tail square.

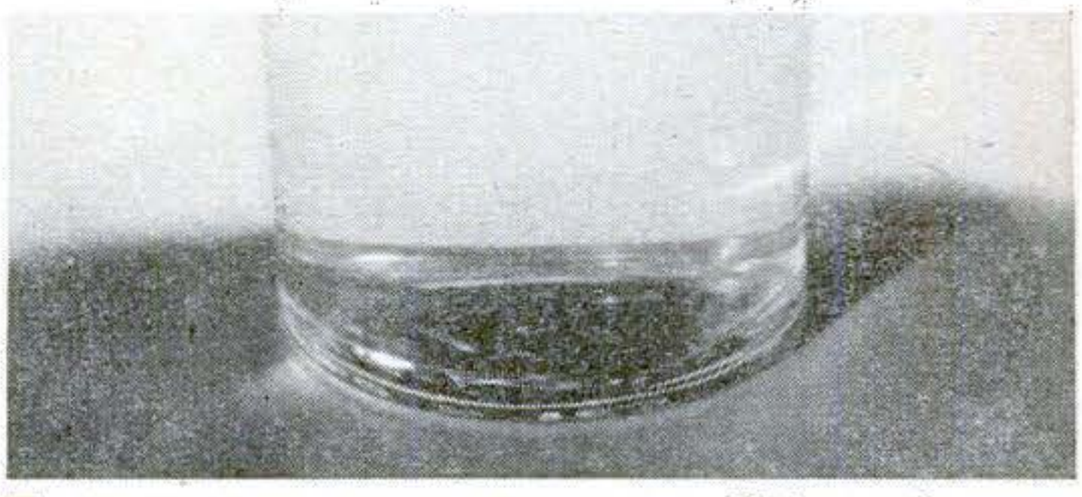


3 SQUEEZE END in vise until it is same diameter as shaft. Apply pressure slowly.



4 SLIP ARROW QUICKLY through holes in glass. Don't scrape wood on glass edges.





5 SOAK TAIL IN WATER to swell it to former shape. When dry, sand raised grain.

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How to Use Power Sanders

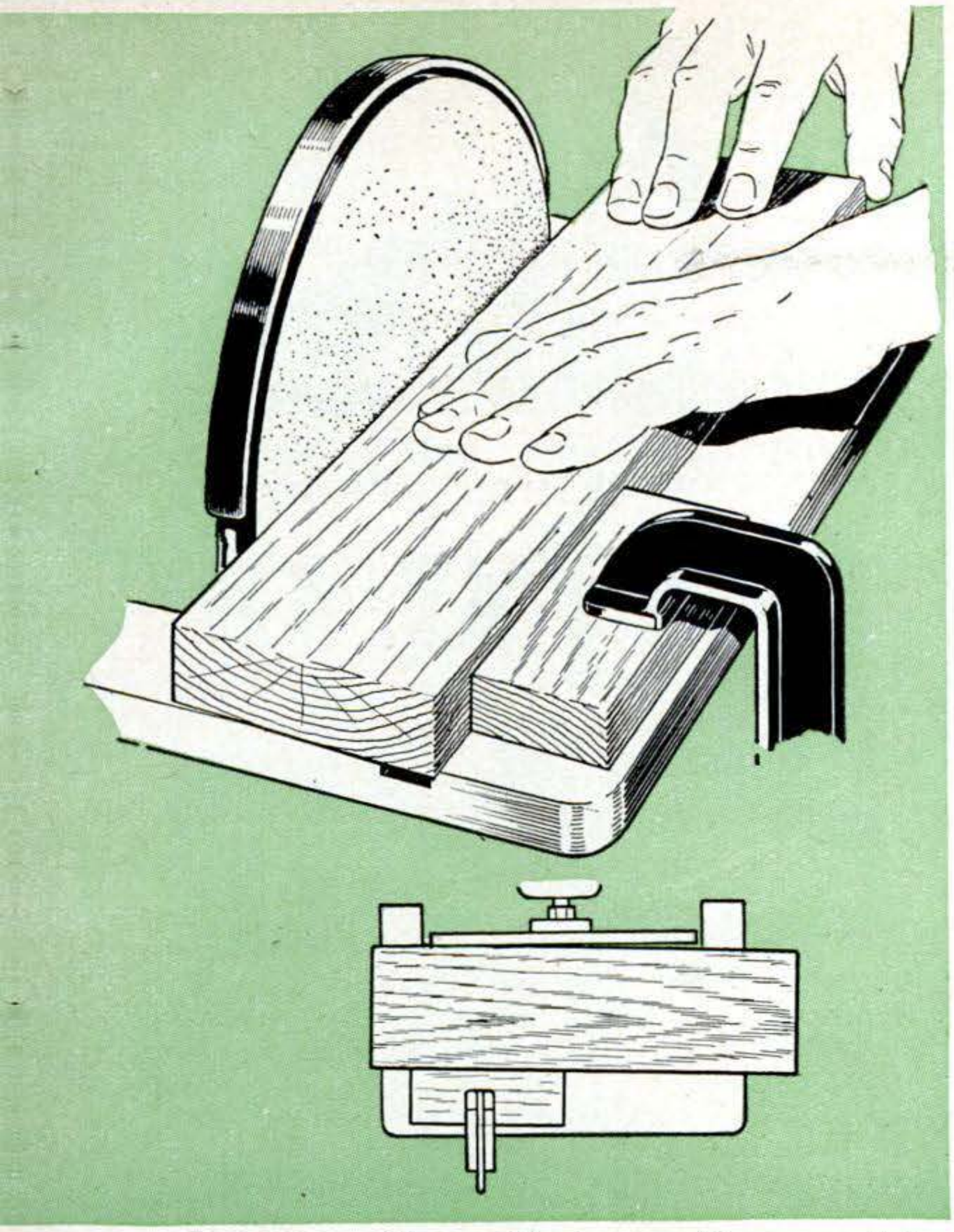
Motor-driven abrasives make quick work of shaping as well as smoothing wood.

POWER sanding compares with hand sanding like a 1952 car with a horse and wagon. Both of them will get you where you are going, but the car does the job a lot faster and easier.

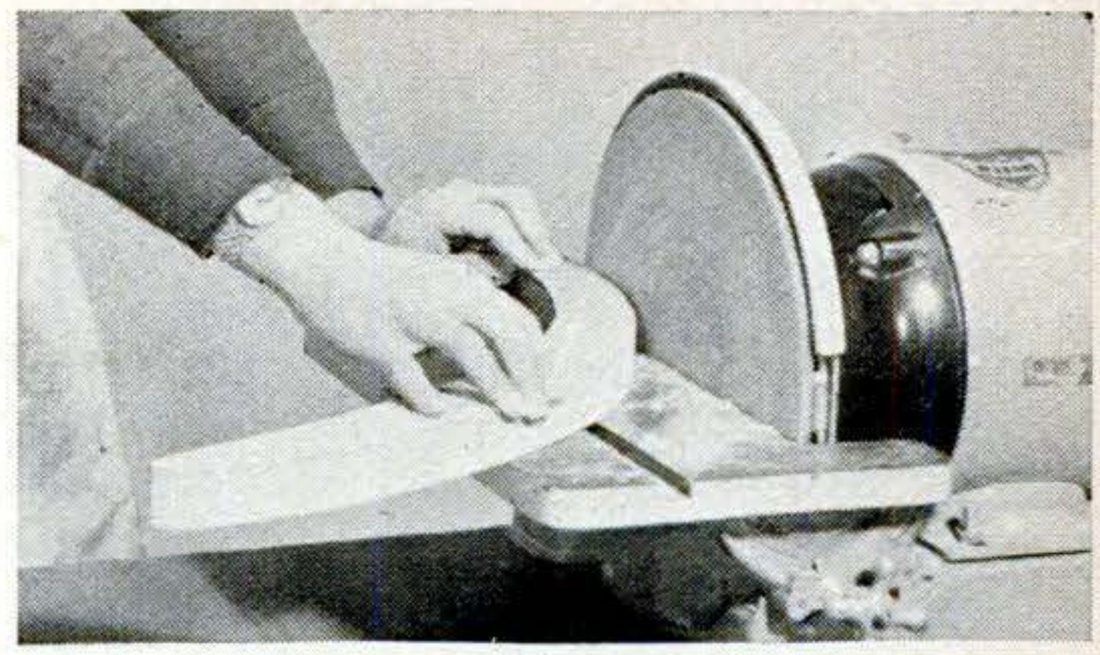
On stationary machine sanders, you just guide the work into the abrasive. A motor supplies the muscle to shape or smooth the work quickly. But how you guide the work into the moving abrasive is important. The photos and drawings on this and the next two pages show the right way to use the three most common types of power sanders—disk, belt and drum—plus some time-saving tricks.

By Edwin M. Love

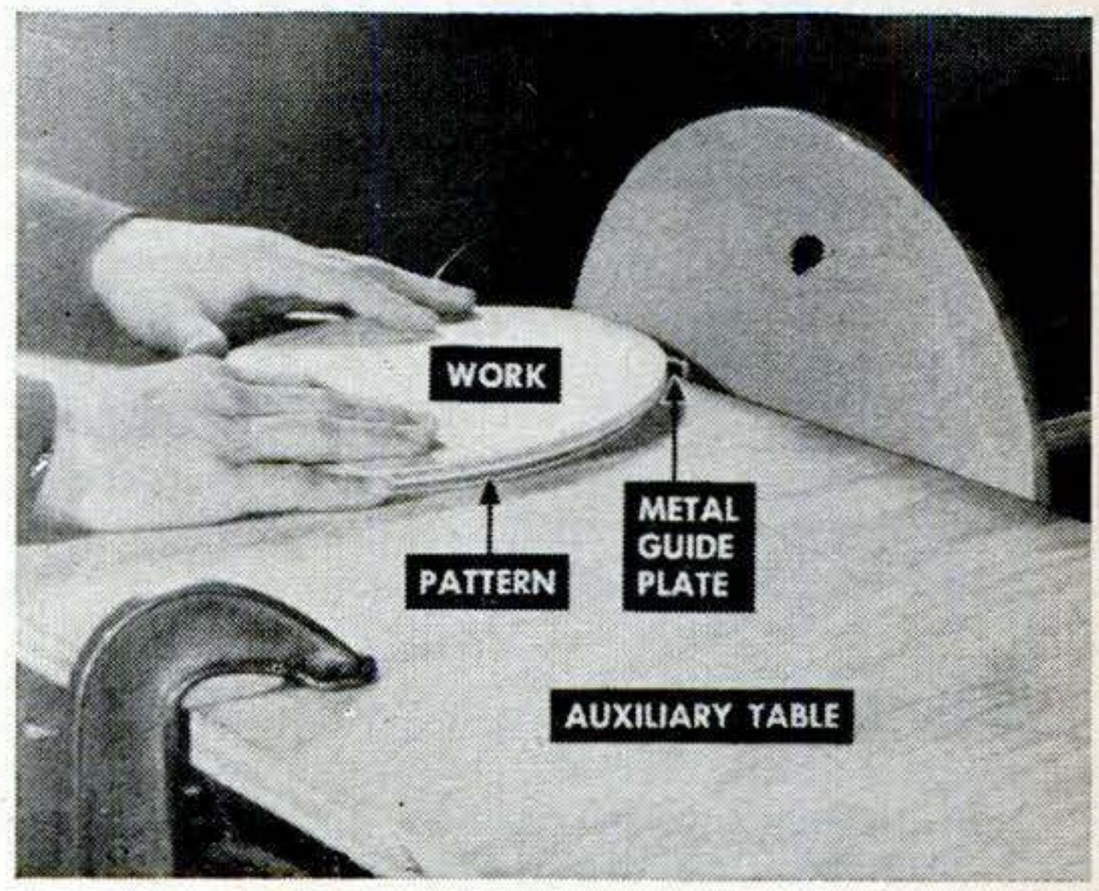
SQUARING ENDS. Lock belt in upright position. Use miter gauge, as in sawing. Shift the work across belt just enough to avoid scoring. When squaring ends with a disk, feed the work against the disk near the center and move the work uniformly outward.



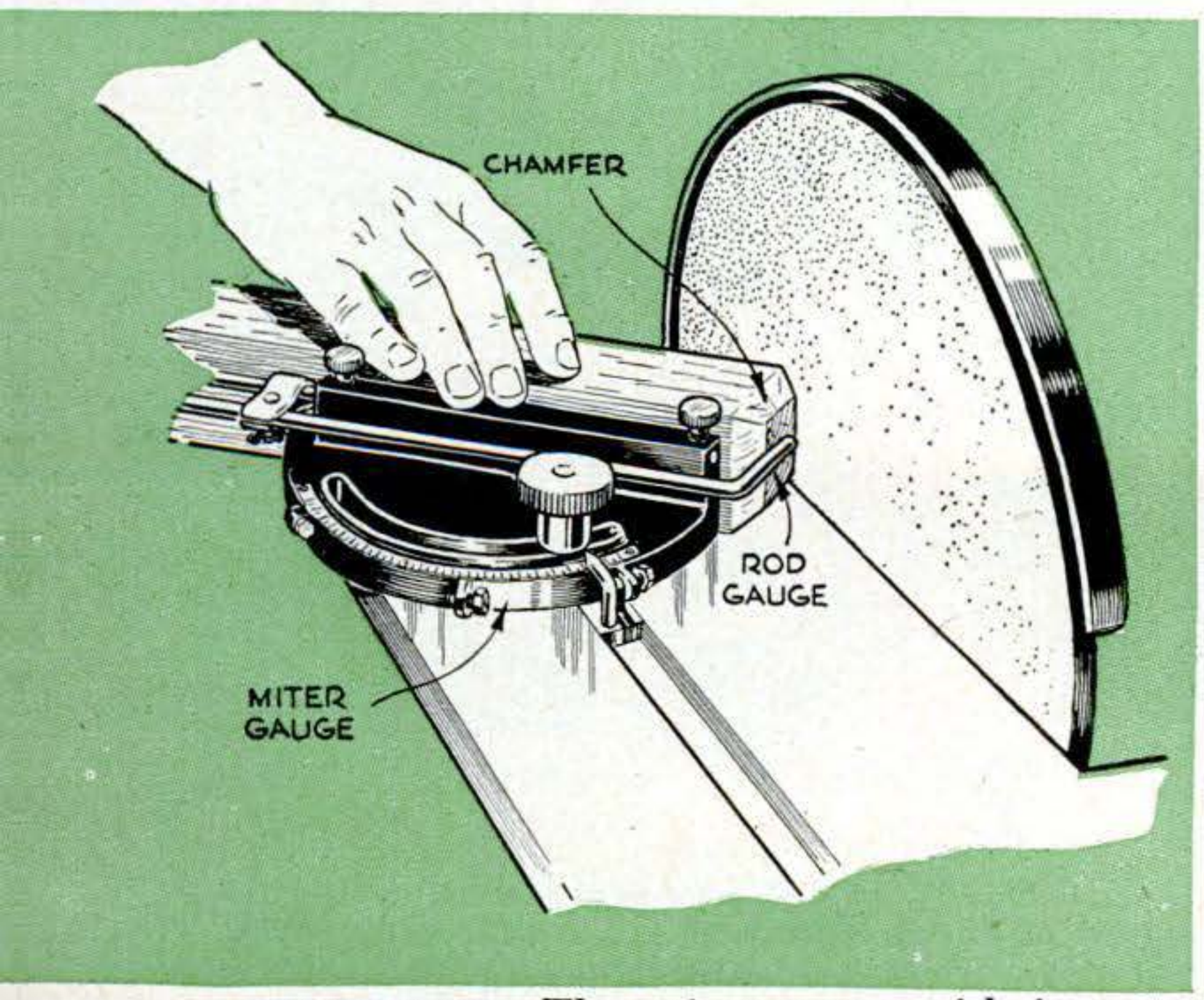
JOINTING. Clamp block to table at a slight angle, as shown above, setting it closer to the disk at the front than at the rear. Feed from the rear so the downward-moving edge of the disk joints the board. Of course, the board must have one straight edge to start with.



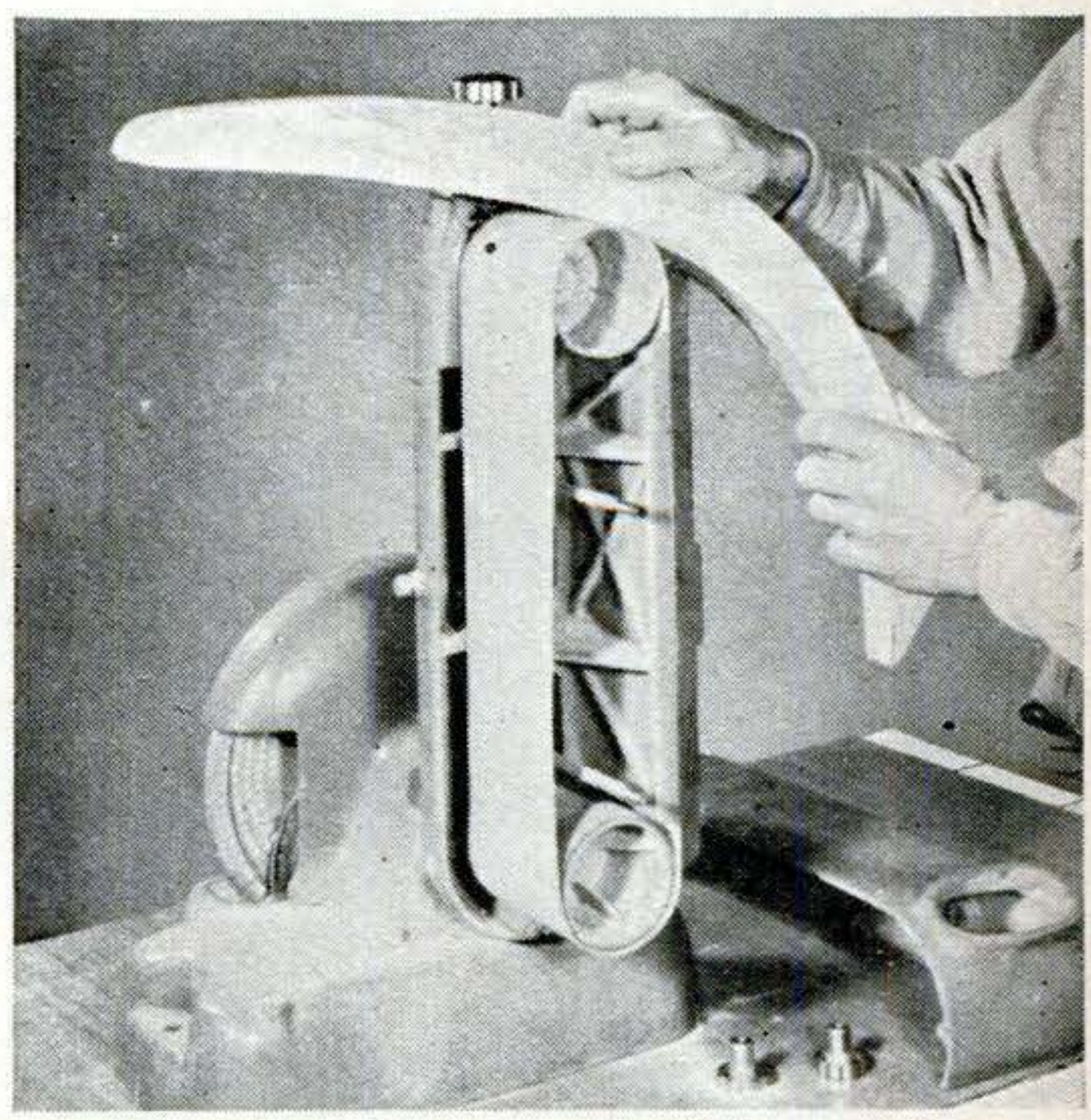
OUTSIDE CURVES. Disk quickly cuts rough-sawed curve to the line. Keep work moving to avoid flats, and hold it down on table.



PATTERN SANDING. Screw a narrow guide plate to edge of auxiliary table. Brad pattern to under side of rough blank. Pattern must be smaller than work to let work project over guide and touch sanding disk. Feed with radius of curve at right angles to disk.



CHAMFERING. The miter gauge with its stop rods simplifies chamfering ends of square stock. When chamfering long work, remove stop rod, set gauge square, and tilt table.



INSIDE CURVES. Remove guard from belt sander and you have an excellent tool for smoothing inside curves. Keep the work moving for a smooth job. *(Continued on next page)*

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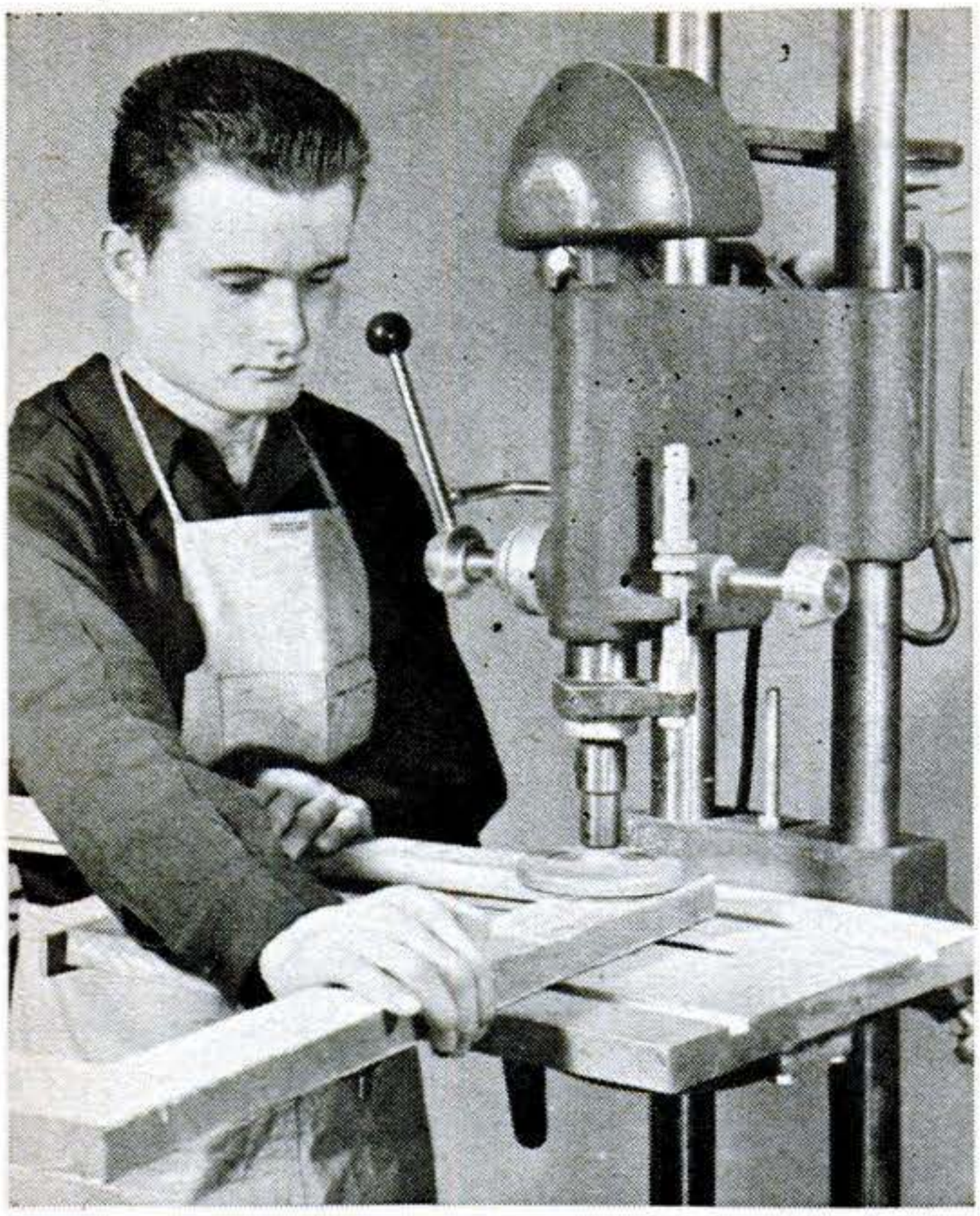
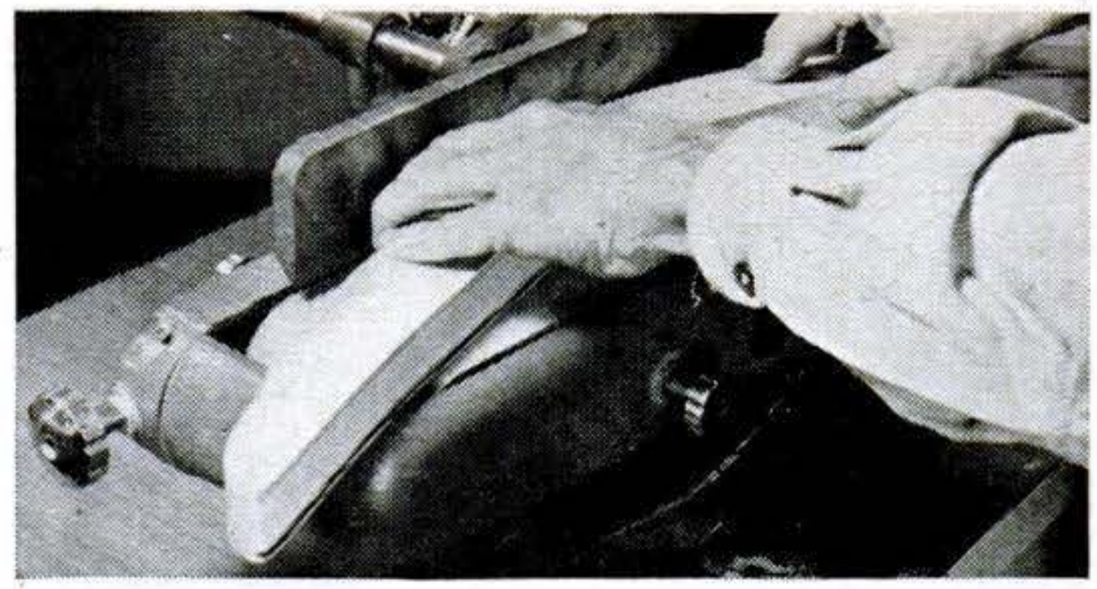
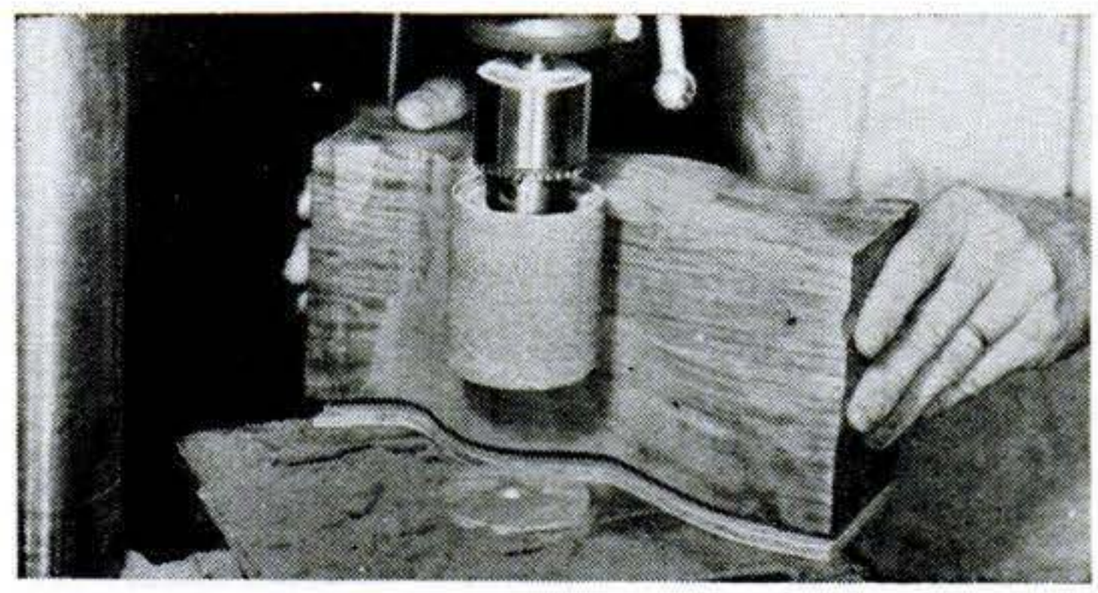


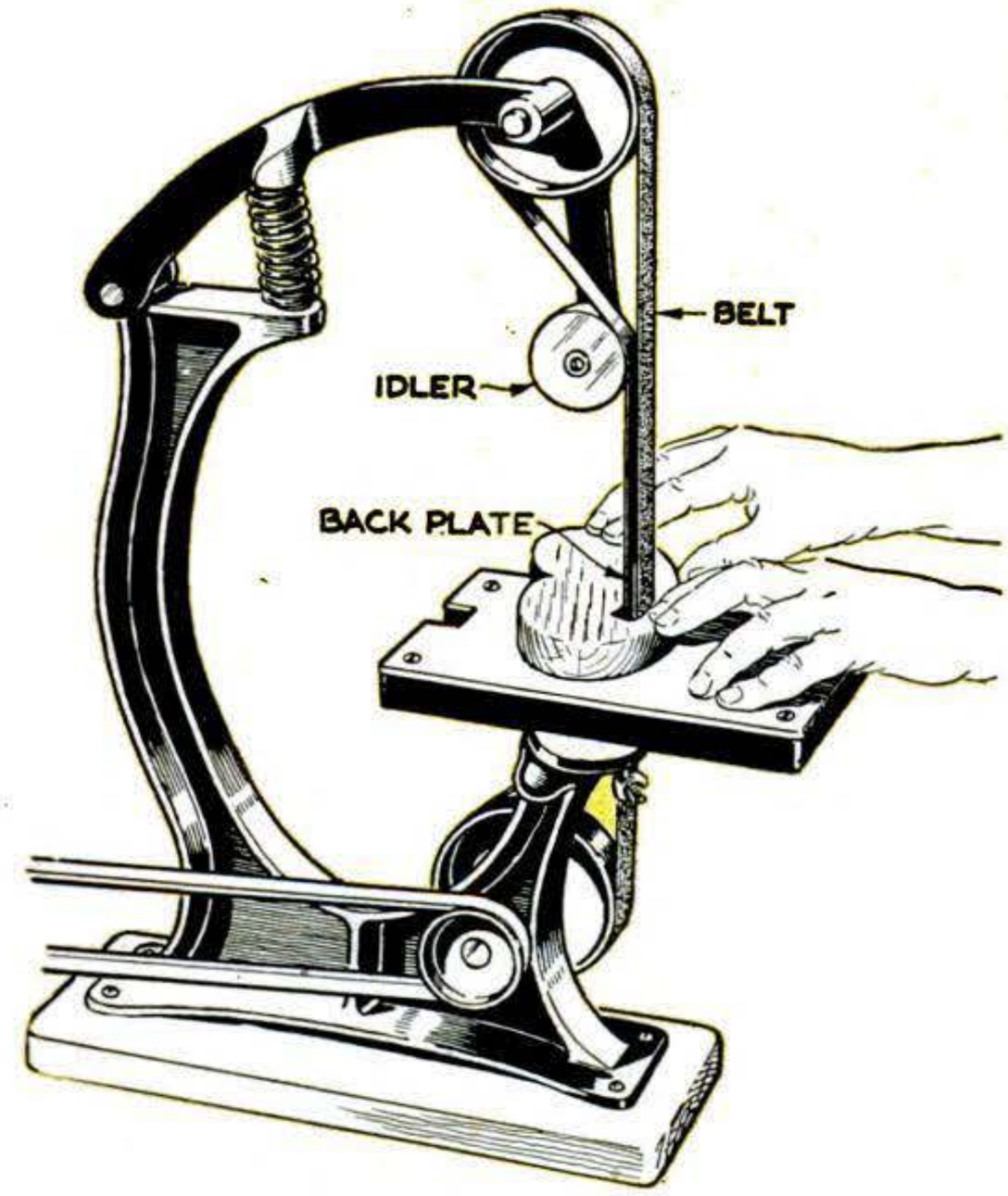
DRILL-PRESS SURFACING. In use above is an accessory made for drill-press surface sanding. This is especially good for making truly flush corner joints on frames. Set disk to press the work lightly. Clamp the quill. Withdraw the work, start the motor and run work through evenly.



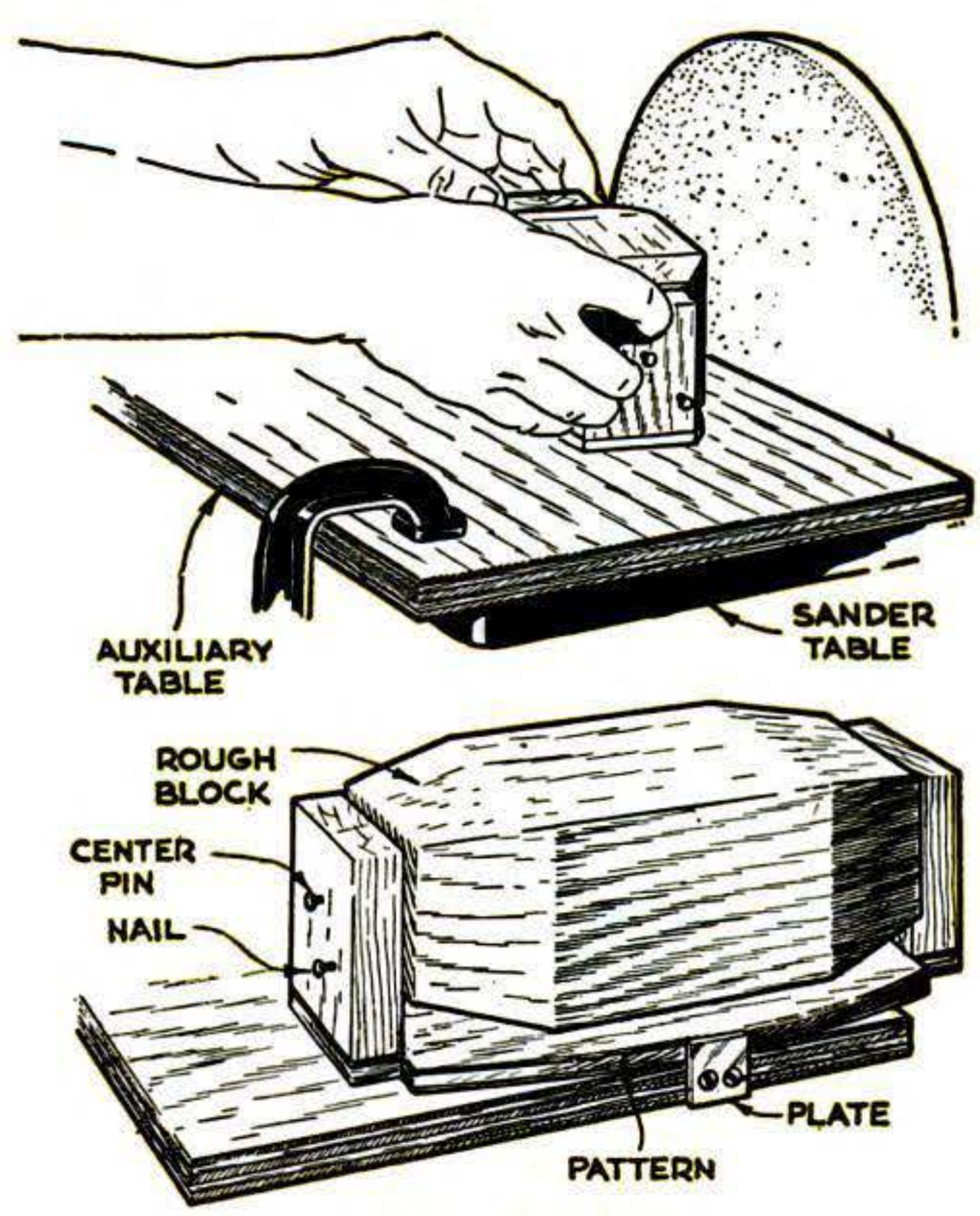
SURFACING. Move work evenly against direction of belt travel. Use uniform pressure.



DRUM SANDING. For perfect work, use the drum with a pattern. Clamp a disk directly below the drum. Both must be exactly same diameter. Tack pattern to bottom of work, with spacers to allow clearance between end of drum and disk. Feed work into revolving drum until pattern rides against the disk.



INSIDE SANDING. This calls for a special machine. Remove belt from upper drum, thread it through opening in table and through hole in work. Adjust idler to move rear, or ascending, part of belt close to back of front belt. Install flat, concave or convex back plate to suit shape of hole in work.



SANDING FOUR SIDES. Locate centers at each end of block and drill for center pins. With a square, set a face of the block parallel to sanding disk. Drive a nail to hold block in that position. After sanding that side, pull nail and rotate block 90°. Square it and drive nail. Repeat for all sides.

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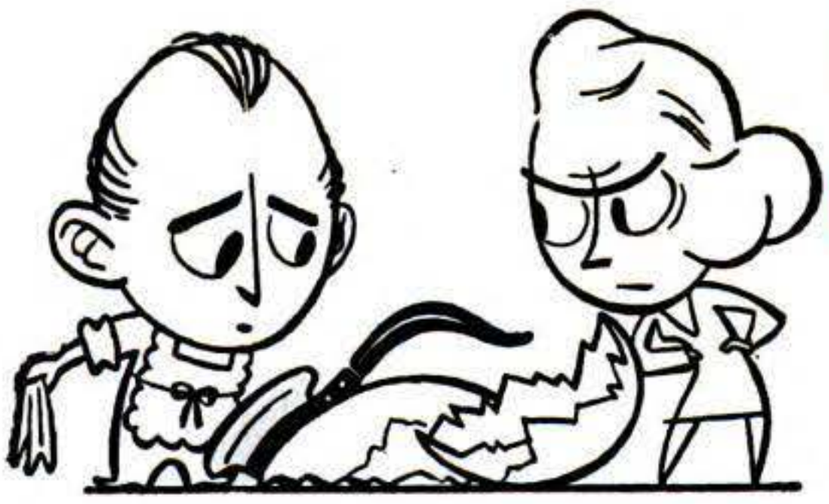
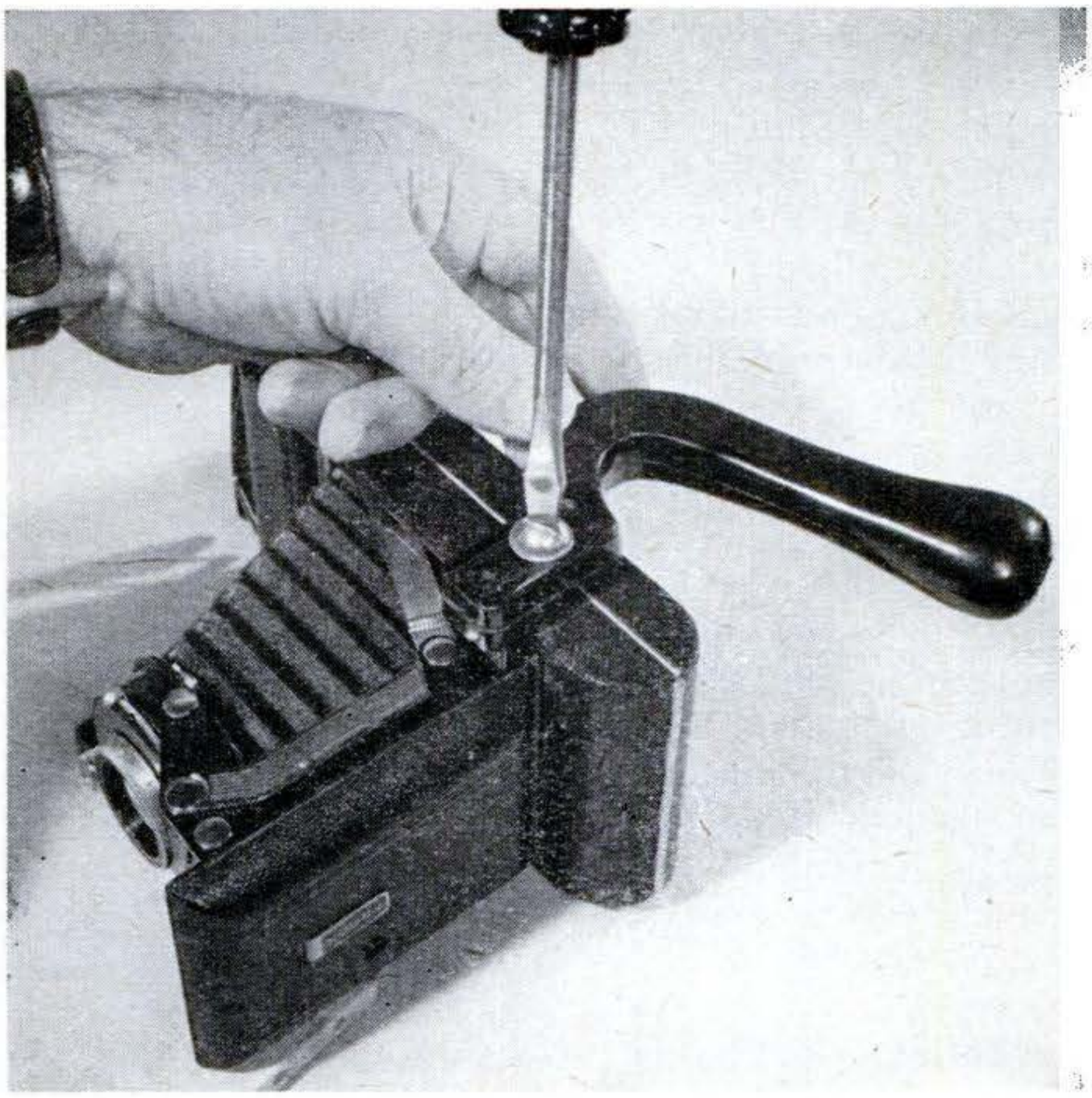


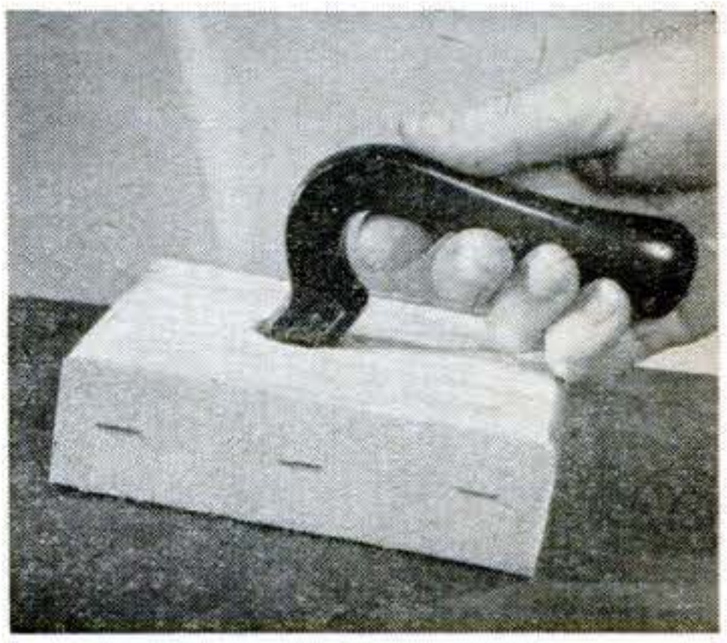
Five Uses for Coffee-Pot Handles

IT PAYS to save the handle when you discard the broken pieces of a glass coffee maker. The wood or plastic grip is shaped to an easy, comfortable fit for your fingers. You will find it just the thing for handling many odd jobs besides those shown here.—*Ken Murray, Colon, Mich.*

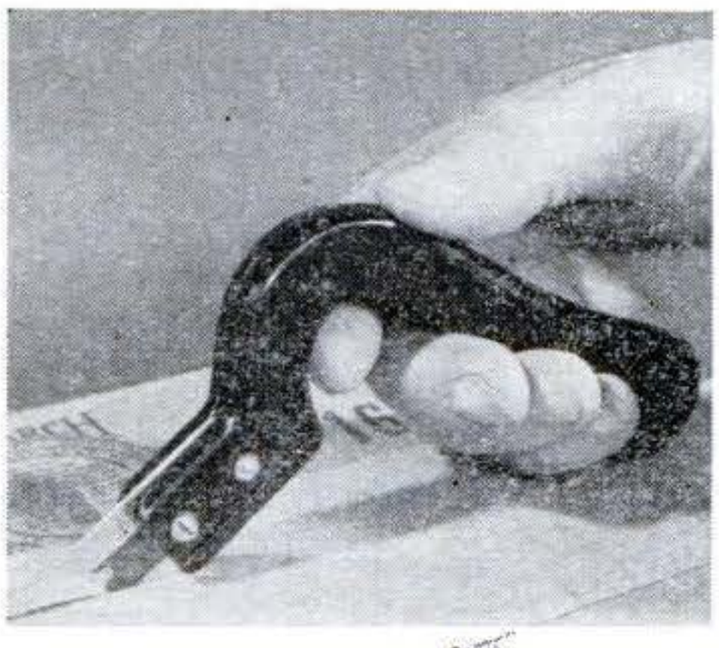
REHANDLING SMALL SAWS makes tedious, finger-straining jobs go faster and easier. Saw a slot in the handle and bolt a compass or keyhole blade inside it. You can handle a file by drilling a hole to fit the tang snugly.



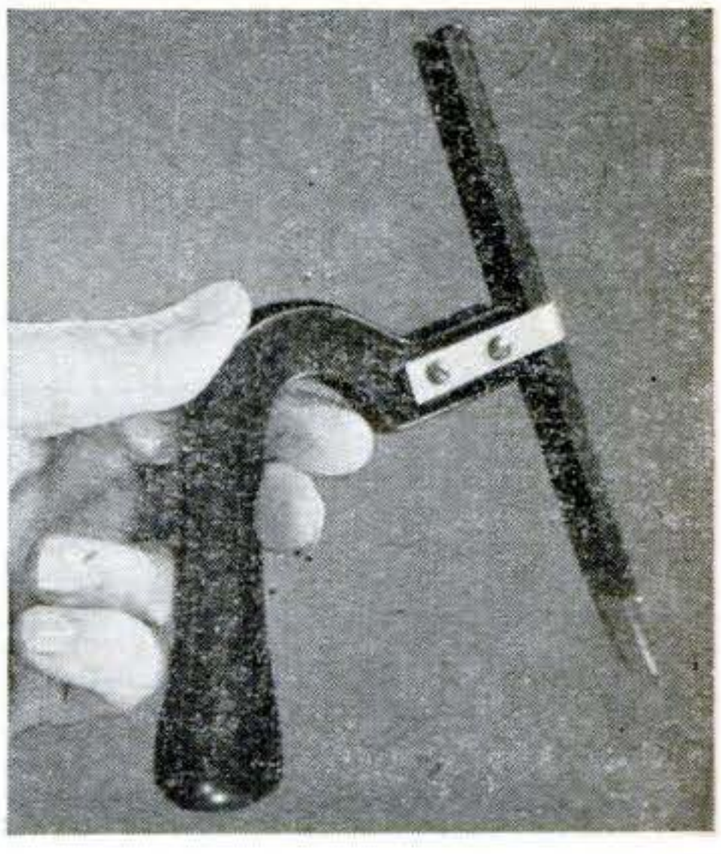
STEADY YOUR CAMERA with a firm holder. Enlarge one of the holes in the handle to take a ¼"-20 bolt, which fits a standard U.S. tripod socket. For one-hand operation, bring cable release around and tape it to the handle.



SMOOTH SANDING can be smoother on the hand. Drill an angled, push-fit hole in the top of a sanding block. Downward pressure locks the handle in. Make separate blocks for different grades of paper. One handle can serve them all.



A UTILITY KNIFE like this (left) is keen for opening cartons, trimming showcard stock and mounting photos. Make a saw slot in the handle and slip in a single-edged razor blade. You can adjust blade to any angle.



SAVE YOUR FINGERS. It takes experience to be a good chiseler and even that may not prevent bruised fingers. To make this chisel holder (right), remove metal band from handle and replace with a shorter one.

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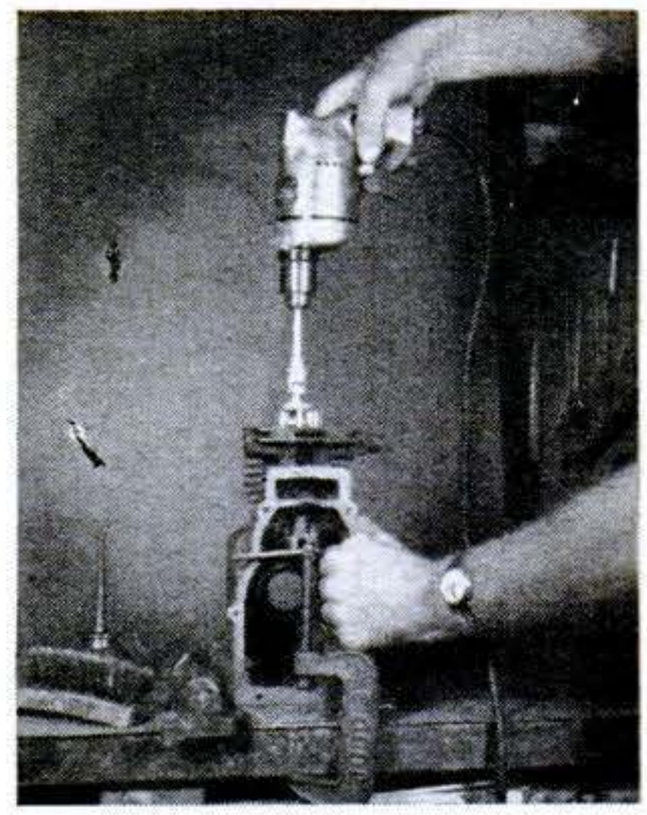


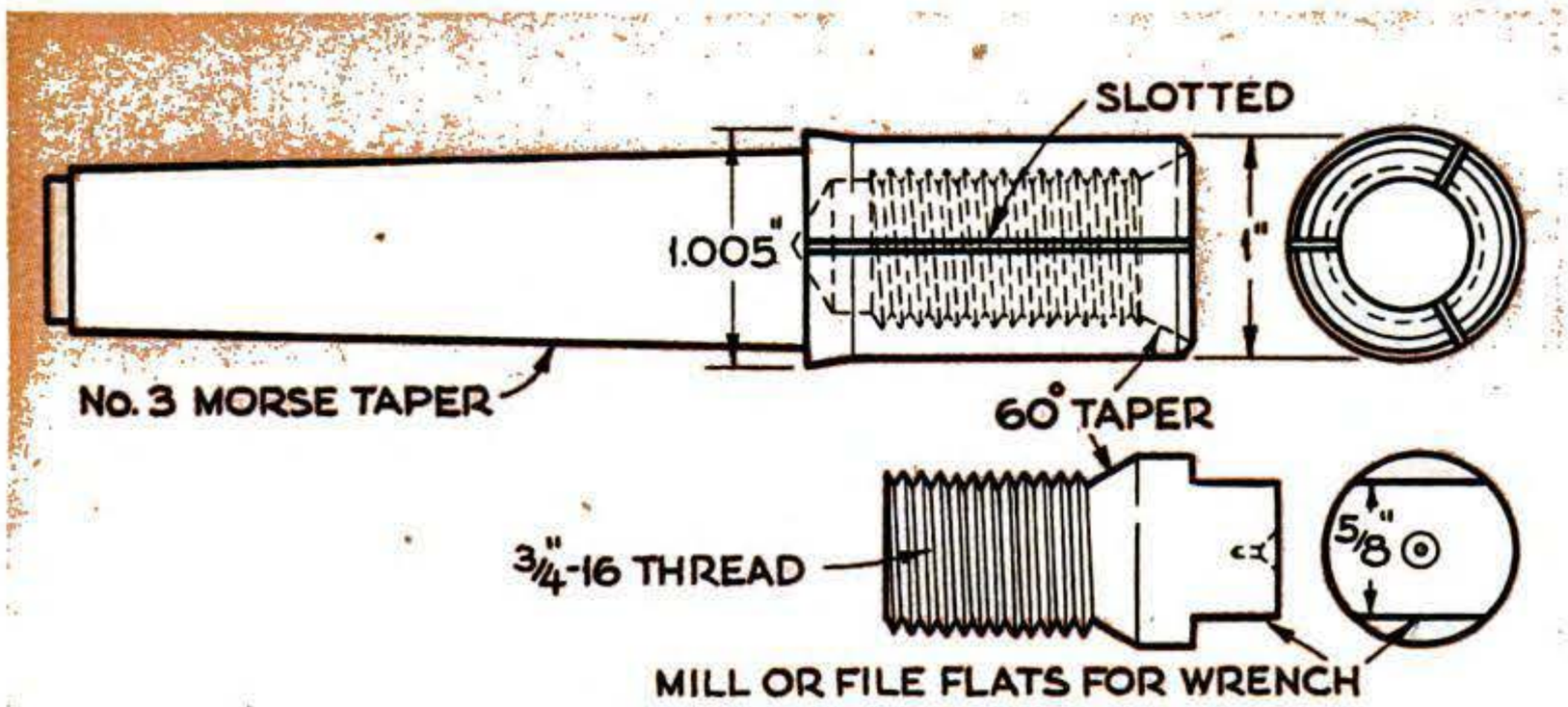
Restoring Cylinders in Small Engines. A hone for hydraulic brake cylinders, available at auto-supply stores, is ideal for rounding out worn cylinders in small gasoline engines and piston-type air compressors. Finish the job with oversize pistons and rings—available from .005″ to .020″ oversize in steps of .005″—and you'll get like-new performance at small cost.

The hone illustrated has four sets of cutting stones ranging from 1½″ to 2½″ in diameter. An adjusting screw sets the stones to .001″ accuracy. Intended for use with an electric drill, the tool has a ¼″ shaft fitted with a universal joint.

Before honing, mike the cylinder bore to determine the required oversize of the new rings or pistons. Clamp the block upright on the bench, oil the cylinder walls and insert the hone. Turn the adjusting screw until it is just possible to rotate the hone with the fingers and then, holding the drill as nearly vertical as possible, begin cutting. Raise and lower the stone constantly in the cylinder. Clean off the cuttings frequently and relubricate. Check the diameter *often* to avoid overcutting, and enlarge the cylinder to its original diameter plus oversize. Readjustment of the stones may be necessary to produce the new bore.—*H. McEntee, Ridgewood, N. J.*

Expanding Mandrel Works Like Collet. An expanding mandrel is not a tool you need every day, but when you want one you want it badly—and in the right size. Here's a type that is easily and quickly made to suit the job at hand.

The 60° taper on the expanding plug engages the matching taper on the mandrel, forcing the three segments apart to grip the bore of the work mounted on it. Note the short taper—.005″ over the mandrel size—which backstops work that is bored oversize.



The No. 3 Morse-taper shank is convenient, but not necessary—you could mount the mandrel between centers and drive it with a lathe dog. If taper shanks are desired, mandrels smaller than ⅞″ should be made with No. 2 Morse tapers and used with an adapter sleeve in the headstock spindle.

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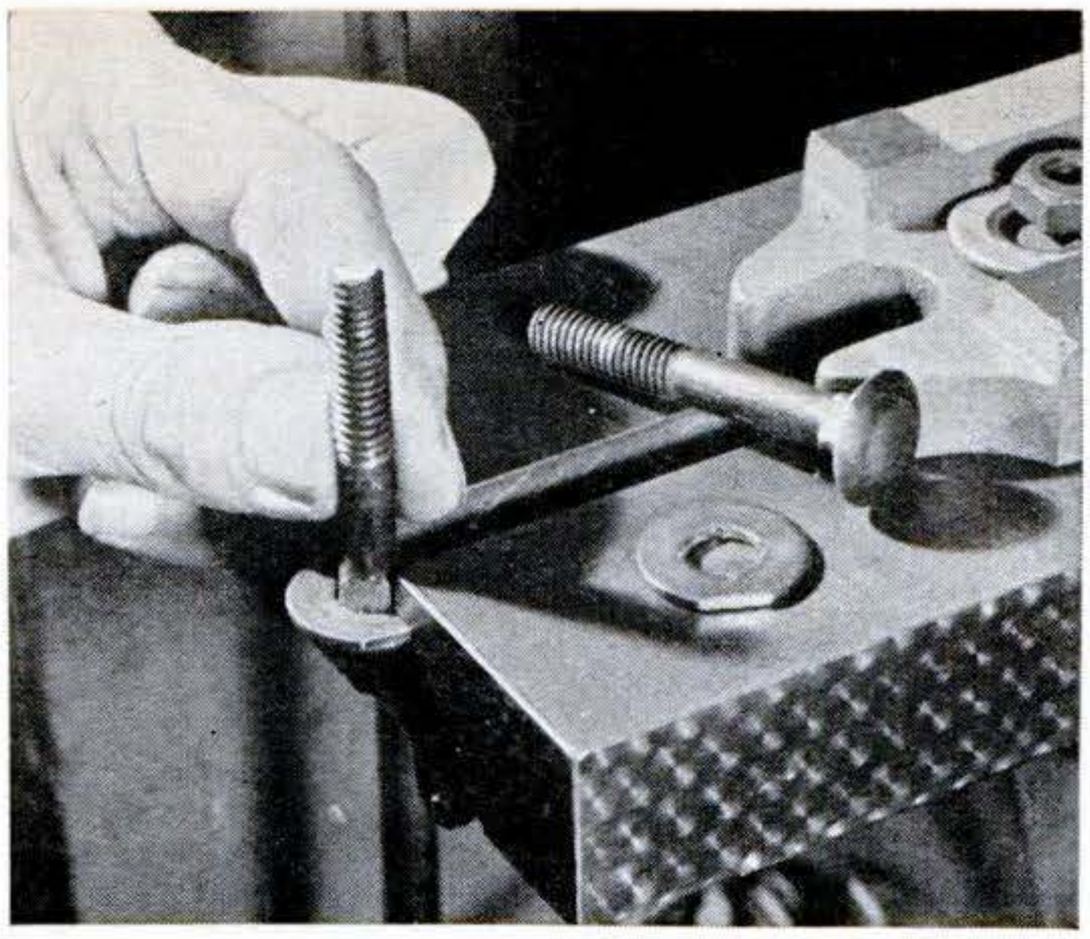
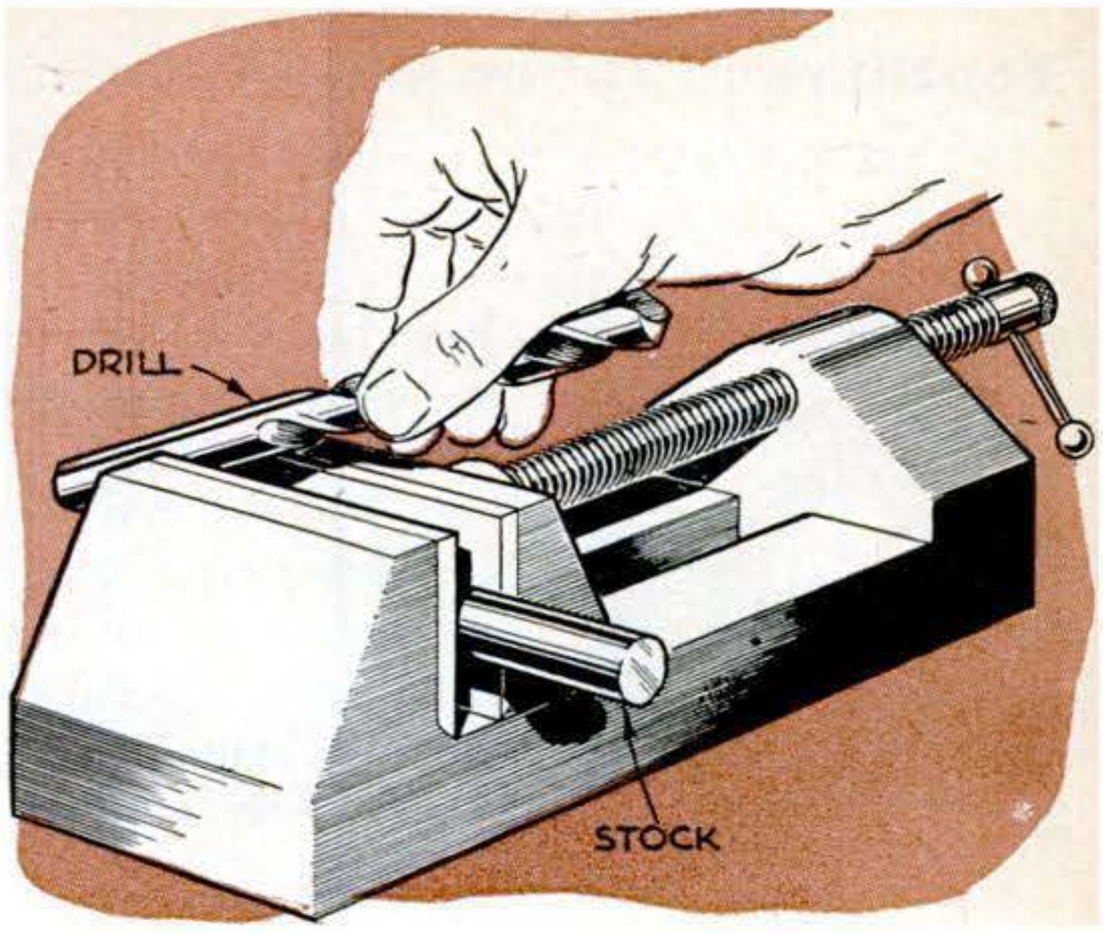


Carriage Bolts Hold Work. Bolts to fit the T slots in milling-machine and other machine-tool tables can be made up in a hurry from carriage bolts and heavy steel washers. One set of washers may be used for bolts of different lengths.

File four notches in each washer hole to fit snugly over the square portion of the bolts. File a flat edge on each side of the washers so that they will enter the slots readily, yet keep the bolt heads from turning when the nuts are tightened to secure the work.—*Walter E. Burton, Akron.*

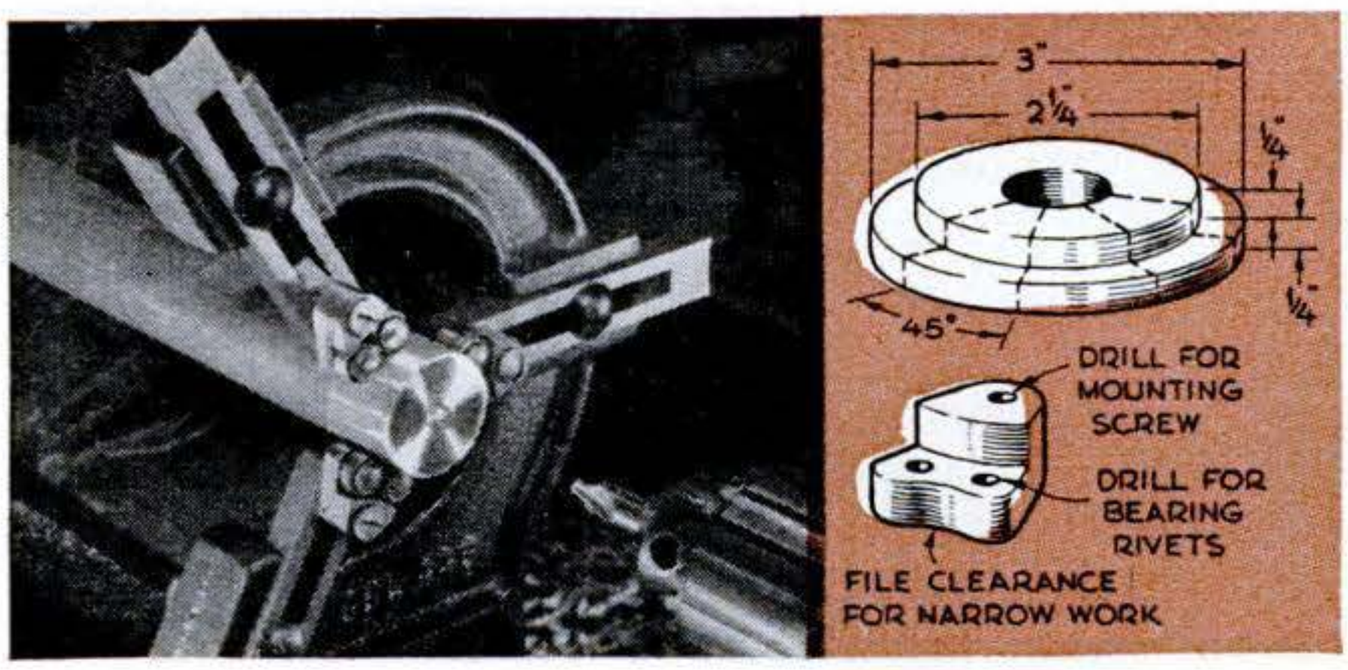


Improvised Micrometer. Approximate but close measurements can be taken without a micrometer by using a vise and a set of drills.

Clamp the work or material lightly in a vise, preferably a drill-press vise, and slip the shanks of various-size drills between the jaws until you find one just too large to fit although the next smaller drill does fit. In the Nos. 1-to-60 drill range, there is a difference of only a few thousandths in each size, and the "go and no go" system is thus fairly accurate when precision isn't vital.—*Hugh Lineback, Stillwater, Okla.*

Ball Bearings Improve Steady Rest. To avoid scoring soft materials supported by a follower or steady rest, fit the adjustable jaws with small ball-bearing assemblies of ⅜″ outer diameter. This modification will permit heavier cuts and higher speeds without marring the work.

The follower rest (right) has a single ball bearing set in a slot cut in each jaw. The steady rest (below) has been a bit more elaborately equipped with two bearings on each jaw. An equalizing mount for each pair of bearings assures full contact against the work. The mounts are made by cutting 45° segments from a brass or steel disk turned as shown in the drawing. If the jaws are made of hardened steel, they must be annealed to permit filing and drilling. Rehardening is unnecessary.—*H. L. Truchelut, Atlanta.*



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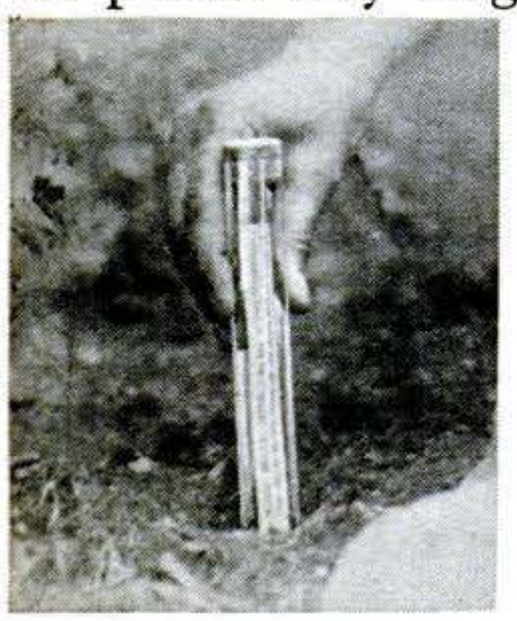
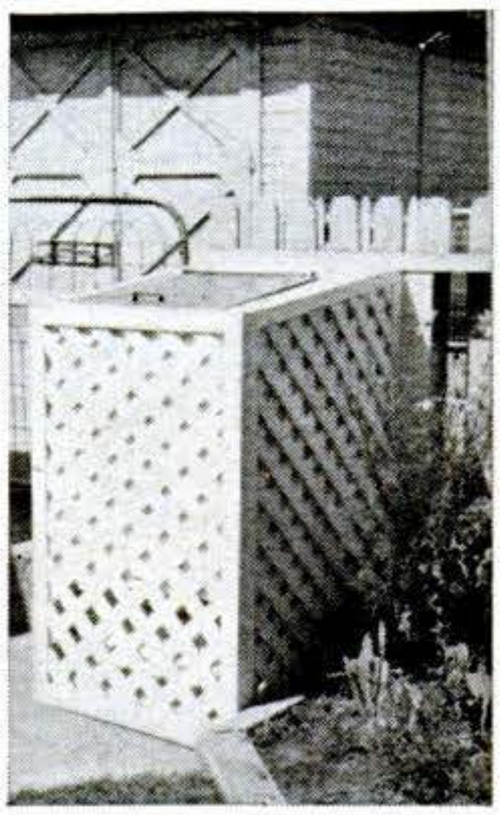
Toothbrush Tubes Mark Plants

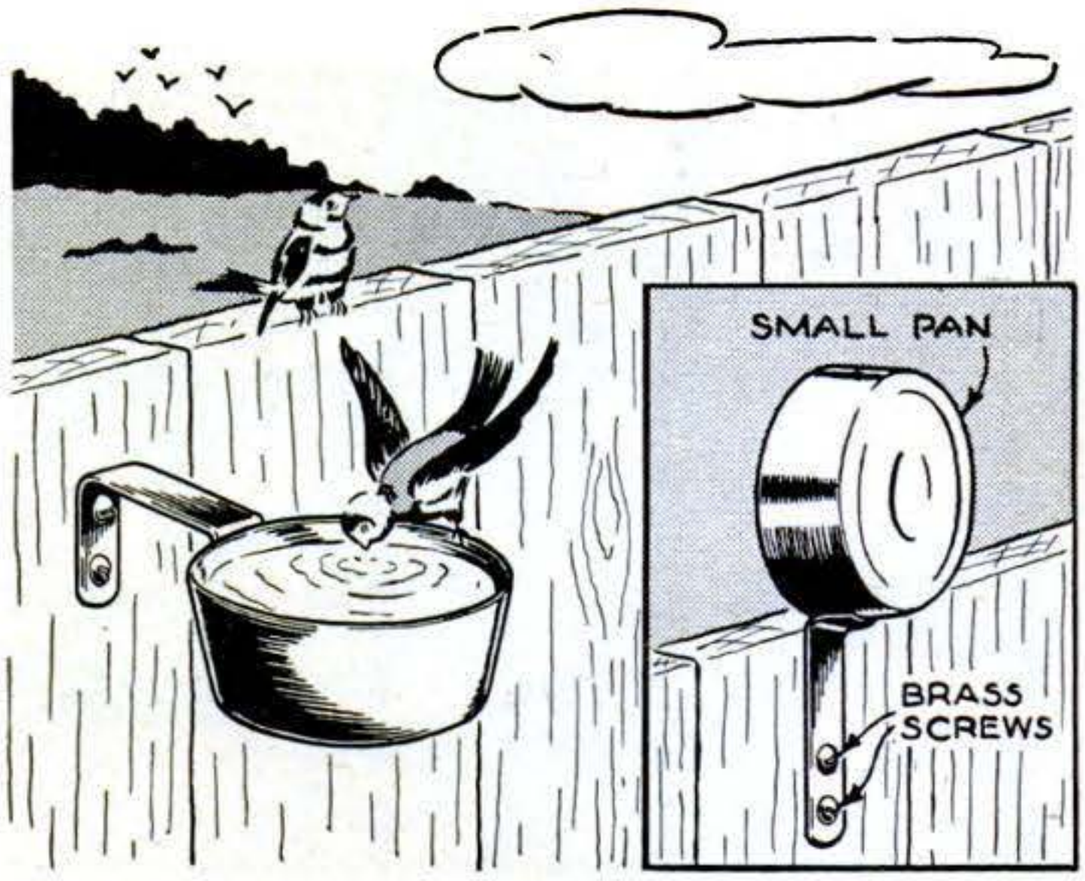
GLASS containers that some new toothbrushes come in make permanent markers for plants. Any long slender bottle—like an olive bottle—also can be used. Make the label slim enough so that it won't have to be curled too much and cork it inside tightly to prevent moisture from seeping in.—*A. Zanelli, Tampa, Fla.*



Latticework Hides Garbage

FRAMES made of one-by-twos and filled with diagonal lattice strips make this box to hide—and keep dogs away from—a garbage can. The lid can be metal or wood. Both the can and the box are painted.—*E. G. Levine, Chicago.*



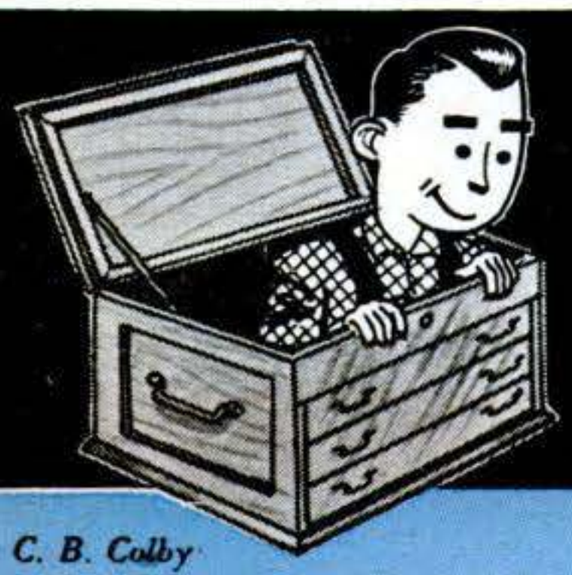


Old Pan Used as Bird Feeder

A SMALL saucepan and two minutes of your time are all it takes to build this backyard bird station. Screw the handle to a fence or post, bend the pan down as shown, and fill it with water or feed—*George Kapitan, The Bronx, N.Y.*

Shoe Polish Whitens Baseball

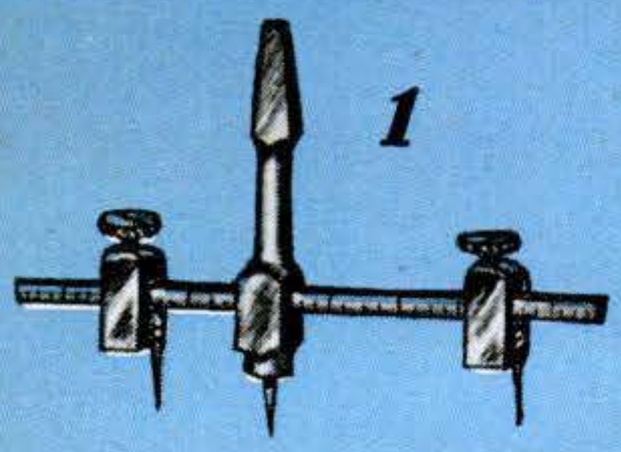
OCCASIONAL applications of white shoe polish will make your son's baseball easier to find when it gets lost in high grass.—*Michael Ligocki, Gary, Ind.*

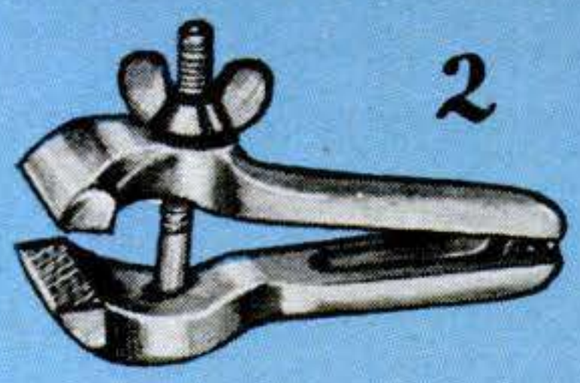


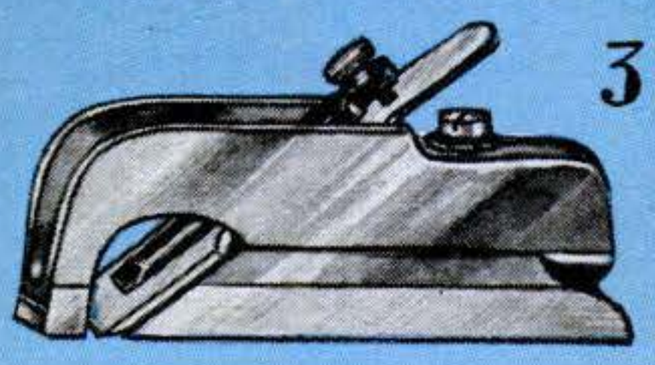
TOOLBOX TEST

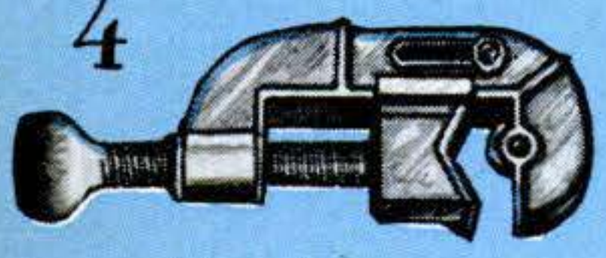
Sharpen up your knowledge of shop tools. Name these and invert the page to score yourself.

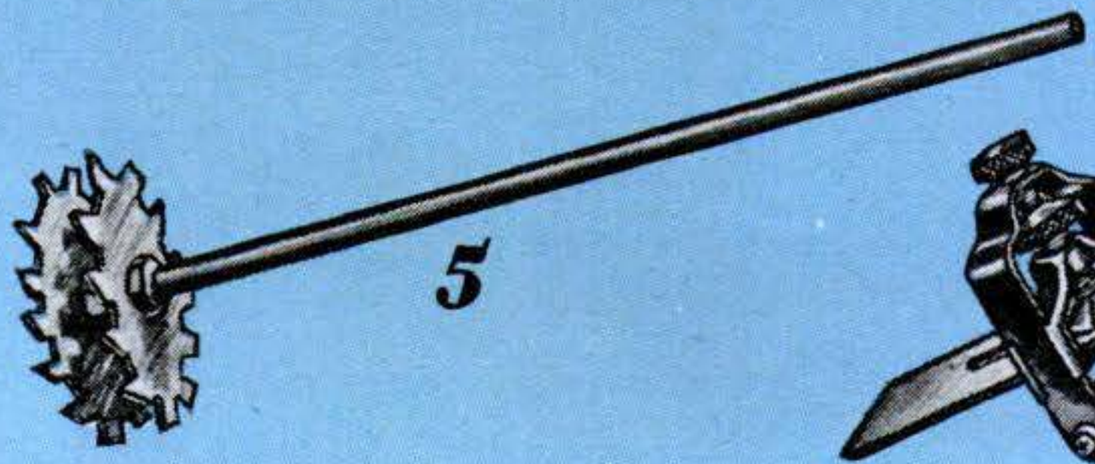
By C. B. Colby

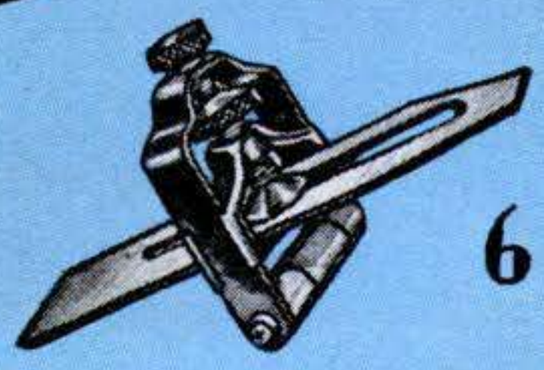












1. Gasket cutter; 2. hand vise; 3. bull-nose rabbet plane; 4. tubing cutter; 5. paint stirrer for use with electric drill; 6. plane-iron sharpener.

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A real mechanic... a born mechanic. To you a job that is "all right" just isn't good enough. You demand perfect workmanship in materials and tools. And you are quick to recognize the work and products of other perfectionists.

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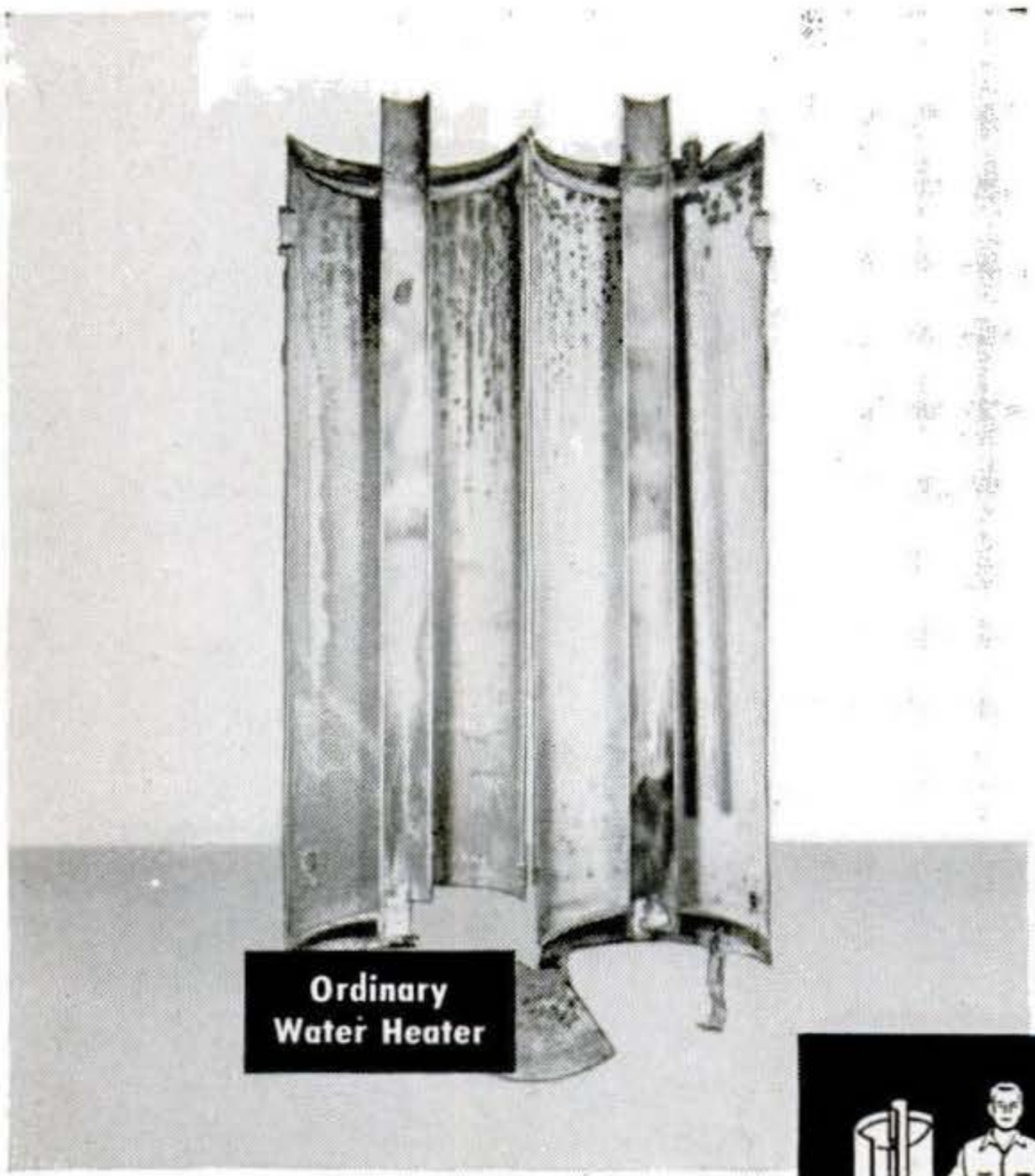
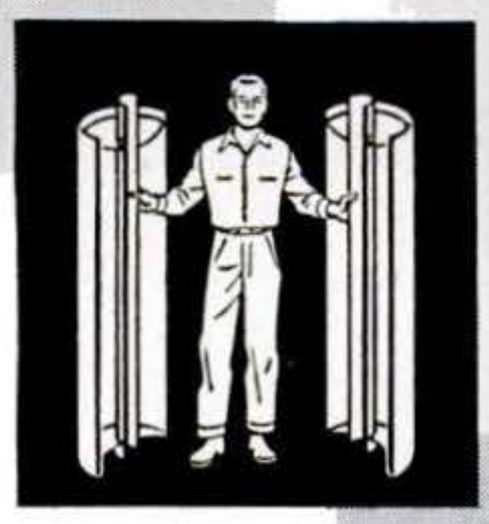
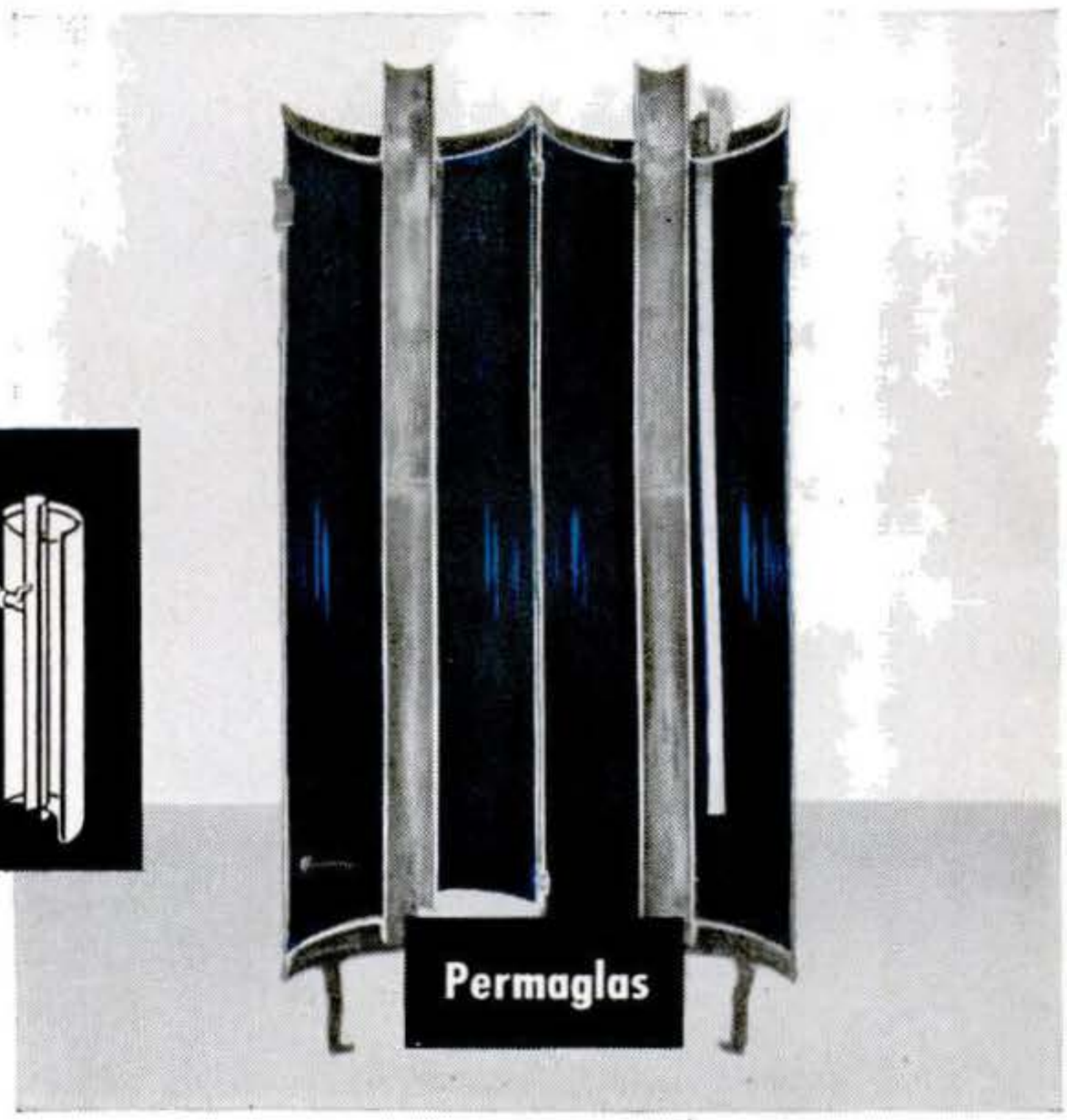


ORDINARY galvanized water heater tank interior after one year of service in a corrosive water area. The left half has deposits of water-borne minerals. The right half has been cleaned to reveal actual surface. NOTE NUMEROUS DEEP RUST PITS, indicating penetration of galvanized surface and rapid destruction of the water heater tank by corrosion.

PERMAGLAS. Glass-surfaced steel tank interior after the same year of service in the same city as the galvanized tank. The left half shows deposits of water-borne minerals. The right half has been cleaned. NOTE ORIGINAL GLASS SURFACE, still smooth and effective against corrosive attack . . . no rust . . . your assurance of many more years of service.





We cut water heaters in two to prove to you

Permaglas is your best buy

Permaglas water heaters and galvanized water heaters of identical design, in service in twelve cities having widely divergent water conditions, were removed at the end of a year and cut in two, lengthwise, for critical inspection.

Conclusive, unmistakable proof of *Permaglas* superiority in resisting corrosion shows up for you to see!

Exclusive *Permaglas* features provide lasting service. They comprise: 1) glass-surfaced steel tank, 2) removal of dissimilar metals from contact with water, 3) shielding of fittings from electrolytic action, and 4) "Neutrolizer" standby protection against attacks by corrosive waters.

For complete information on *Permaglas* water heaters, electric, gas or LP-gas, mail the coupon.

A.O.Smith

A. O. Smith Corporation
Water Heater Division, Dept. PS-452
Kankakee, Illinois

Send me, without obligation, your FREE booklet on the inside story of *Permaglas* water heater superiority. Please include information on

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AUTOMATIC WATER HEATERS

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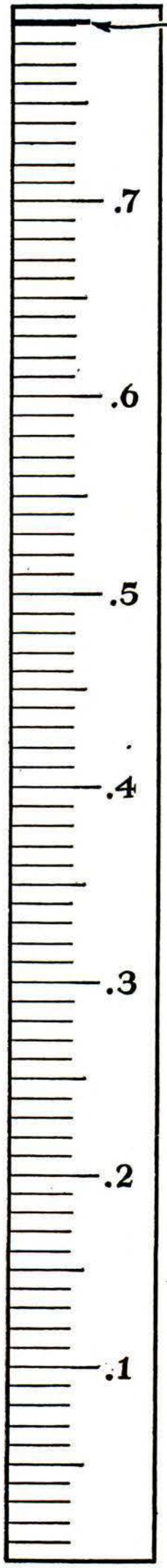

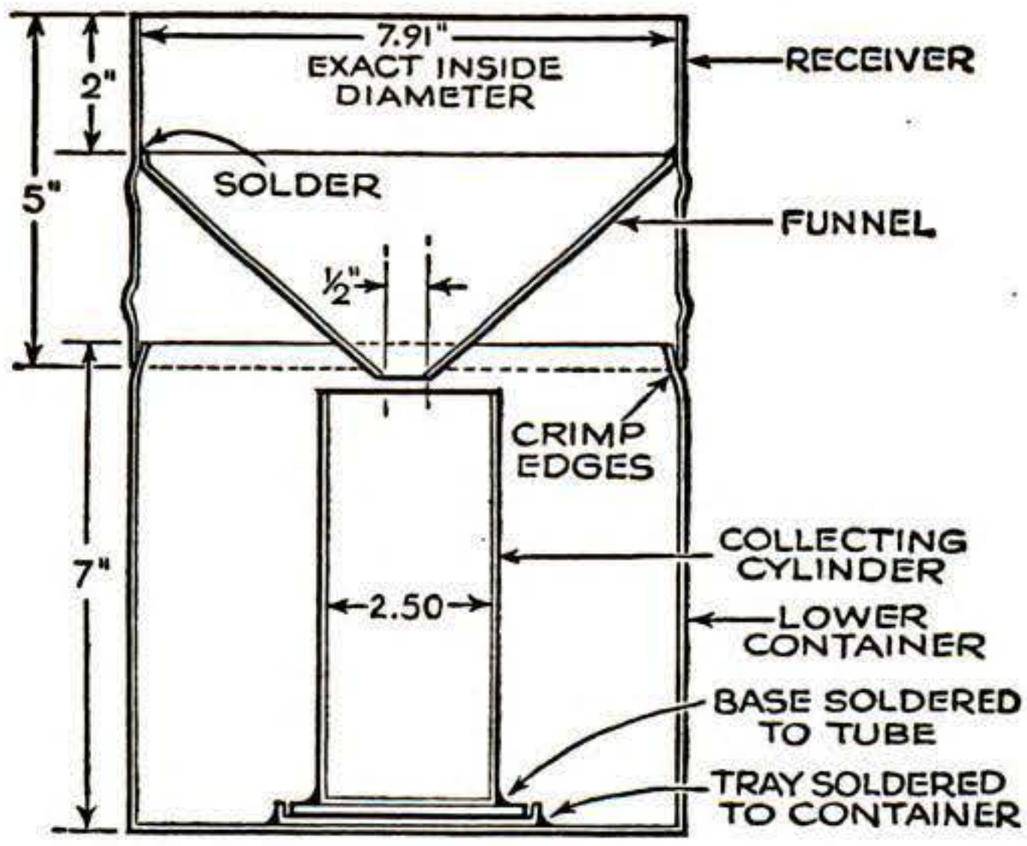

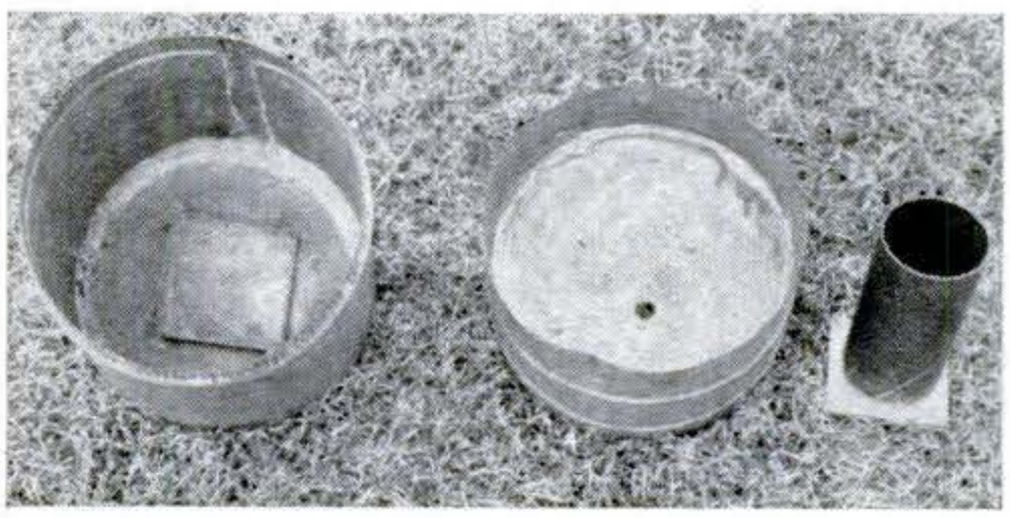

Homemade Gauge Measures Rainfall

Inexpensive device lets you check on weather—man-made or natural.

FARMERS, ranchers and amateur weathermen can keep accurate rainfall records with this inexpensive gauge. You could even check up on the cloud seeders' performance.

Rain that falls into the receiver passes through a funnel into a collecting cylinder having a cross section exactly one-tenth the area of the receiver opening. Water height, multiplied 10 times by the small tube, can be measured directly with a suitably scaled dip stick.

You can make a gauge like this—or have it made by a local tinsmith—from brass tube and galvanized sheet stock. The dimensions given in the drawing are based on an inner-tube diameter of 2.50″. This is a stock size of red-brass plumbers' tubing. Cut a 6″ length of tubing and solder a small square of brass or galvanized iron over one end. Make the receiver by carefully bending a 5″ by 26″ strip of galvanized iron into a cylinder having an inside diameter at the top of exactly 7.91″ (see scale marking at upper left). Shape a funnel from sheet stock or alter a ready-made one to fit, and solder it inside the receiver as shown.

Make a closed cylinder for the lower container and crimp the edges so they will fit tightly inside the bottom rim of the receiver. To measure water height you will need a ruler accurately marked in tenths of an inch. If a ready-made one is not available, copy the scale at the left on a smooth ⅛″ by ⅝″ stick. The scale is drawn to actual size and calibrated 1/10″ to the inch. Each line represents .01 inch of precipitation.

Place the gauge in the open, away from buildings and trees and three feet or more above the ground.—*David F. Costello, Fort Collins, Colo.*

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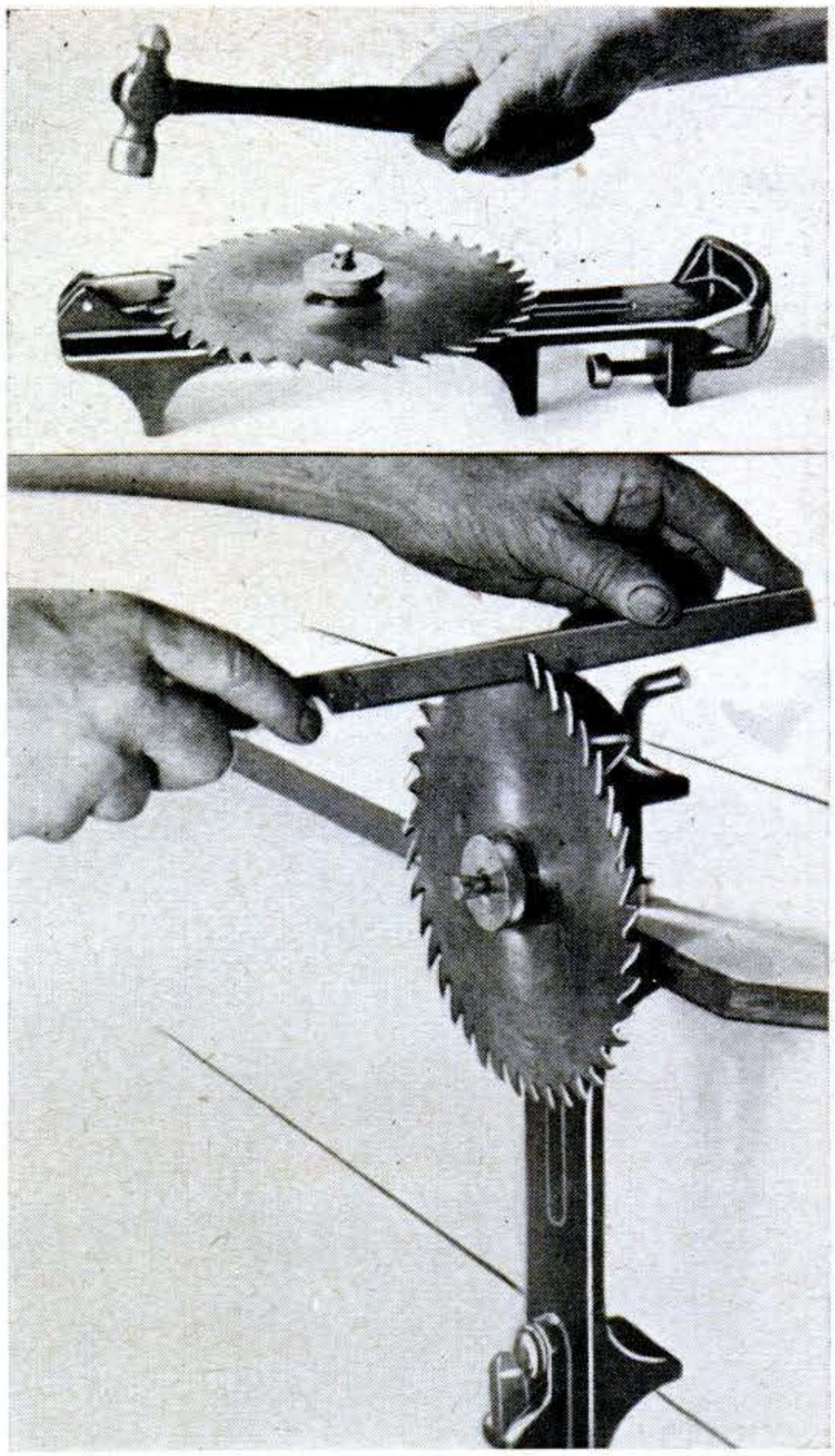
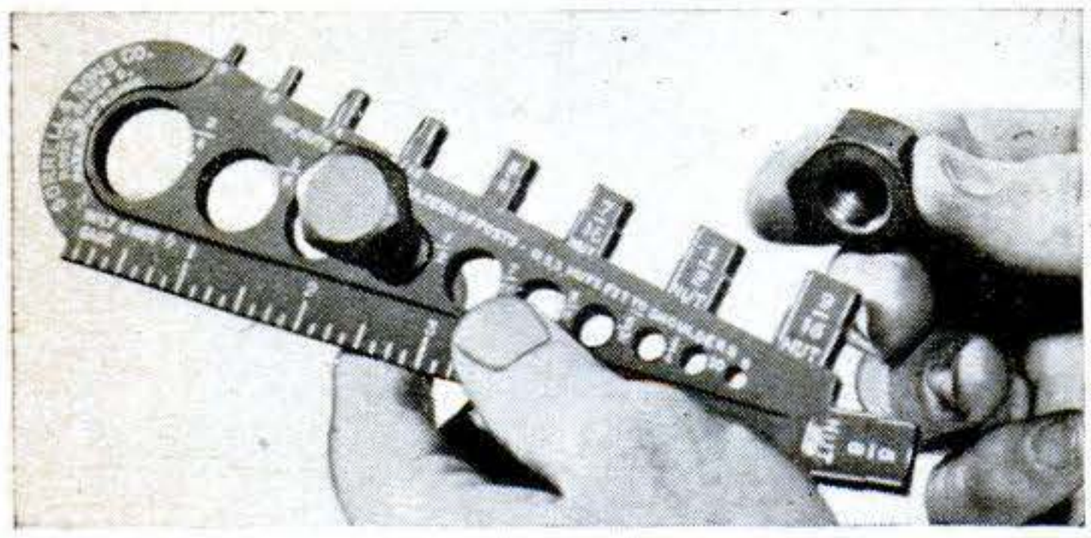
New Tools

Protractor Gives Three Readings. With one setting, readings for an outside angle, the adjacent inside angle, and pitch in inches per foot can all be taken with this protractor. Embedded calibrations cannot be worn off. The tool is made of Vinylite plastic. *Interstate Sales Co., New York City.*

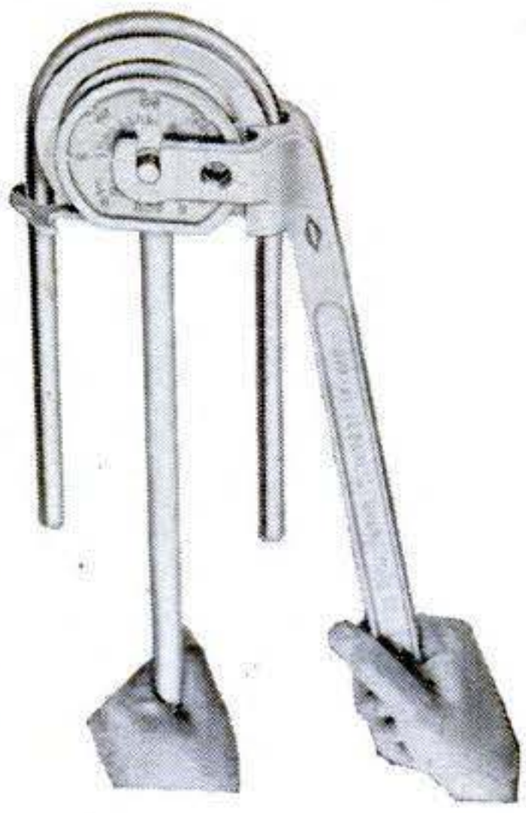


Saw Set Is Also Filing Vise. This tool is adjustable for circular saw blades from 6″ to 18″ in diameter and accommodates all standard arbor holes. In a horizontal position, the tool sets teeth at 15°. It can be clamped to a bench for filing the teeth. *Clark & Sawyer, Los Angeles.*

Bolt and Nut Gauge Fits Pocket. The tool below will gauge bolts and screws from No. 8 through ¾″ diameter and nuts from No. 8 through ⅝″ diameter. Besides indicating diameter, the nut gauges tell whether the nut is coarse thread or fine thread. The instrument is 7¼″ long. *Sorrell & Sons Co., Rocky River, Ohio.*



Bender Handles Tubing of Two Sizes. A dual-size shoe and mandrel enables this bender to take both ½″ and ⅝″ outside-diameter copper, aluminum, brass and other soft, thin-wall metal tubing. The tool can be used to bend tubing that has one end connected. Bends can be made as great as 180°. Weighing three pounds, the bending tool is 21″ long over-all. *Imperial Brass Mfg. Co., Chicago.*



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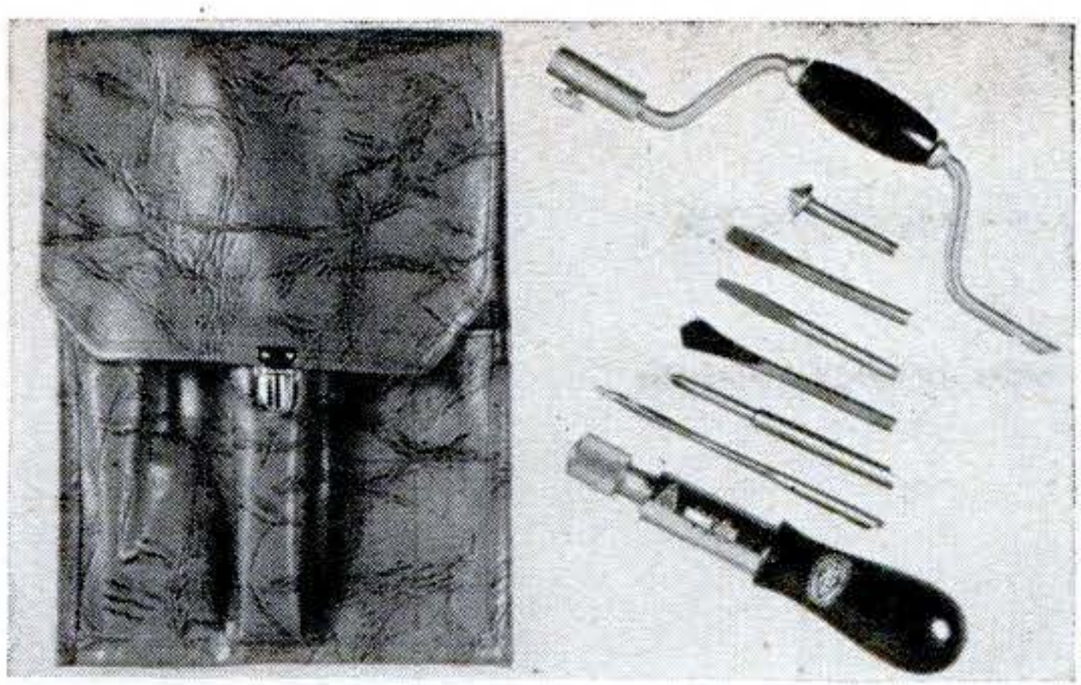
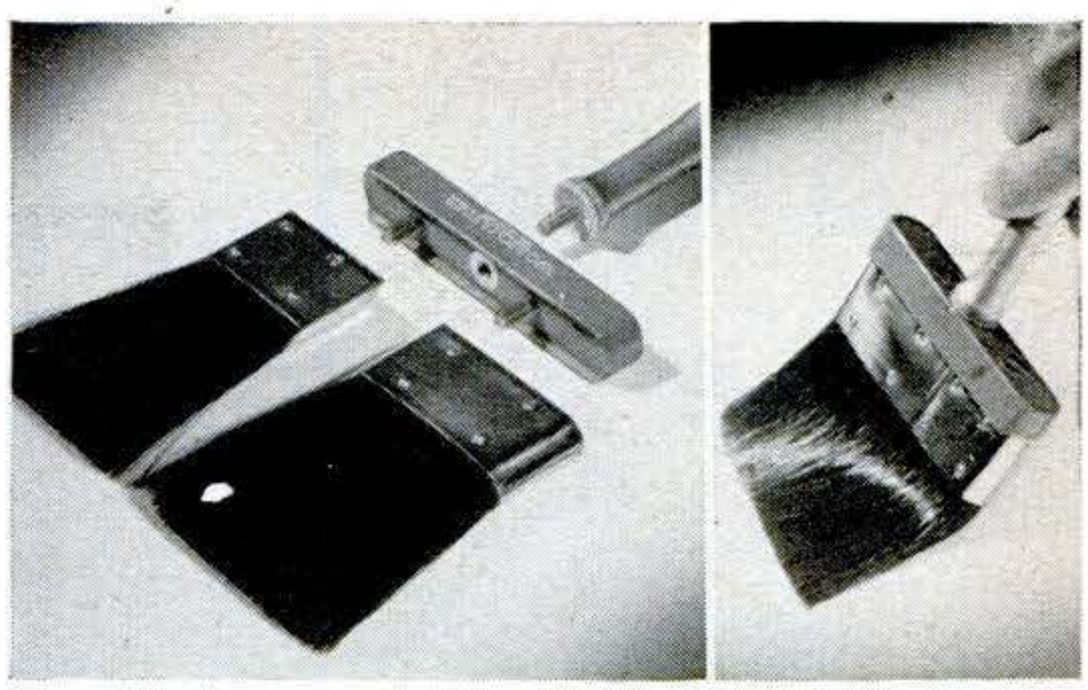
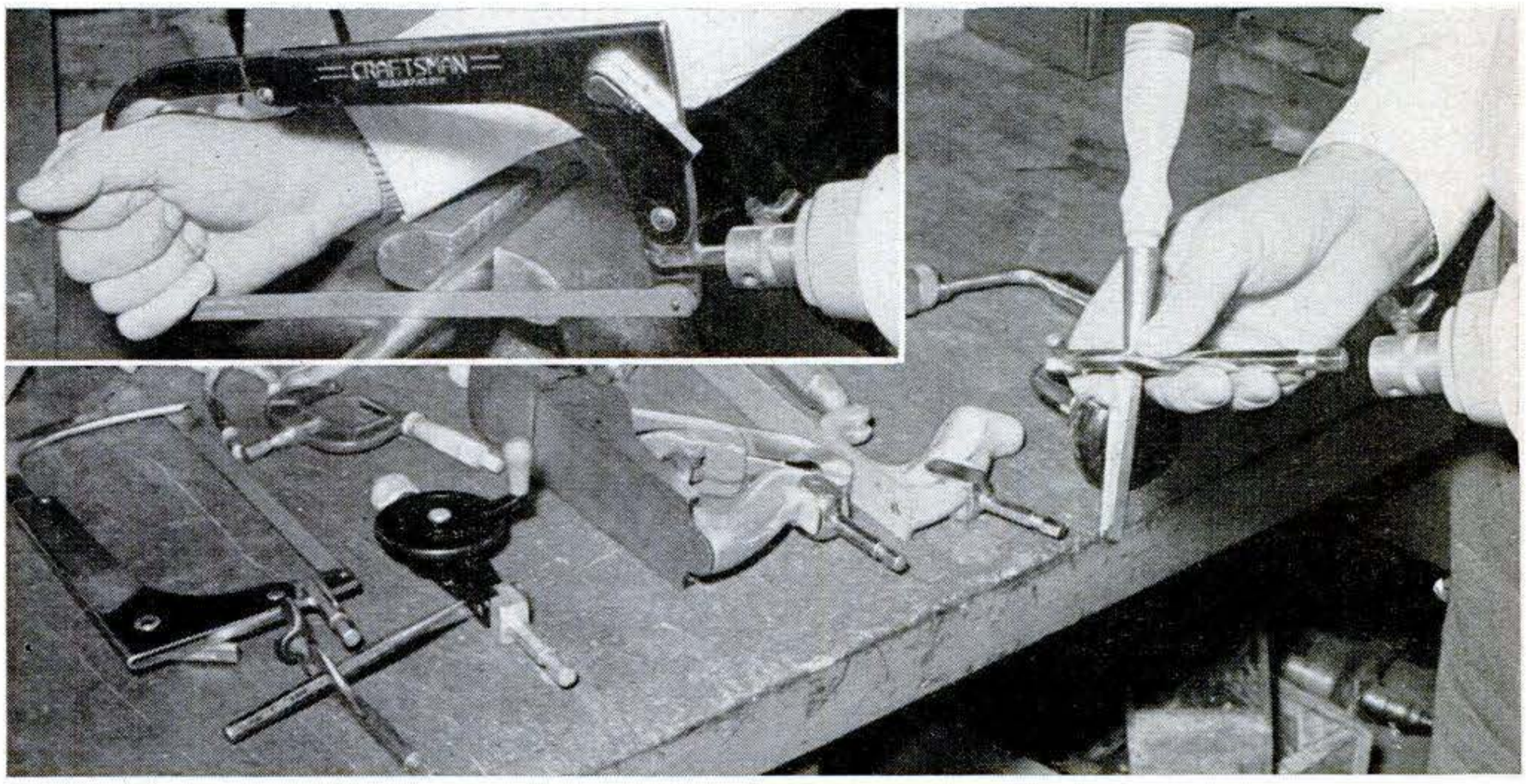


Brace and Bits in Pocket Kit. A ratchet screwdriver that can be converted to a ratchet brace is included in this kit. Other attachments are two screwdriver bits, a gimlet bit, two countersinks and a Phillips screwdriver bit. With the brace chucked in the ratchet handle, over-all length is 12¼". *E. Miltenberg, Inc., New York City.*



Three Brushes in One. Remove two machine screws and this 4" wall brush becomes two smaller brushes—a 1½" sash brush and a 2½" varnish brush. The same handle is used for all brushes. Reassembled, the units form the 4" brush. The bristles, 2¾" long, are a mixture of synthetic and hog. *Sears, Roebuck and Co.*

Equipped with These Special Hand Tools, Arm Amputees Take Shopwork in Their Stride



Tools for amputees fit socket rather than hand (far right). Inset shows a saw in use.

THE handicap of an artificial arm no longer need keep a man from doing shopwork. Special hand tools now available are adapted for use with a socket that screws into the standard type of artificial arm.

The socket is shaped to fit hexagonal lugs that are welded or clamped onto the hand tools. A wing nut locks the lug in the adapter, providing the amputee with a firm "grip" on the tool. The lugs on all tools will fit the same adapter.

Among the tools adapted in this way are pliers, chisel, hand drill, combination square, micrometer, bit brace, ratchet wrench, file holder and hacksaw.

In addition to these individual tools, C. K. Bedford, Inc., of Hazel Park, Mich., makes entire kits of Ampt-Tul aids for various craftsmen, such as auto mechanics, carpenters, cabinetmakers and radio and TV repairmen.

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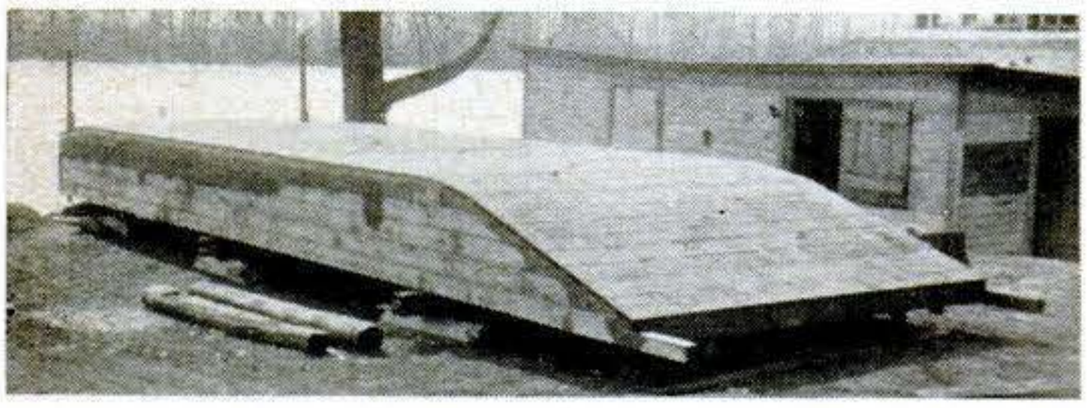
How Skipper Percey Built the Ark of Oshkosh

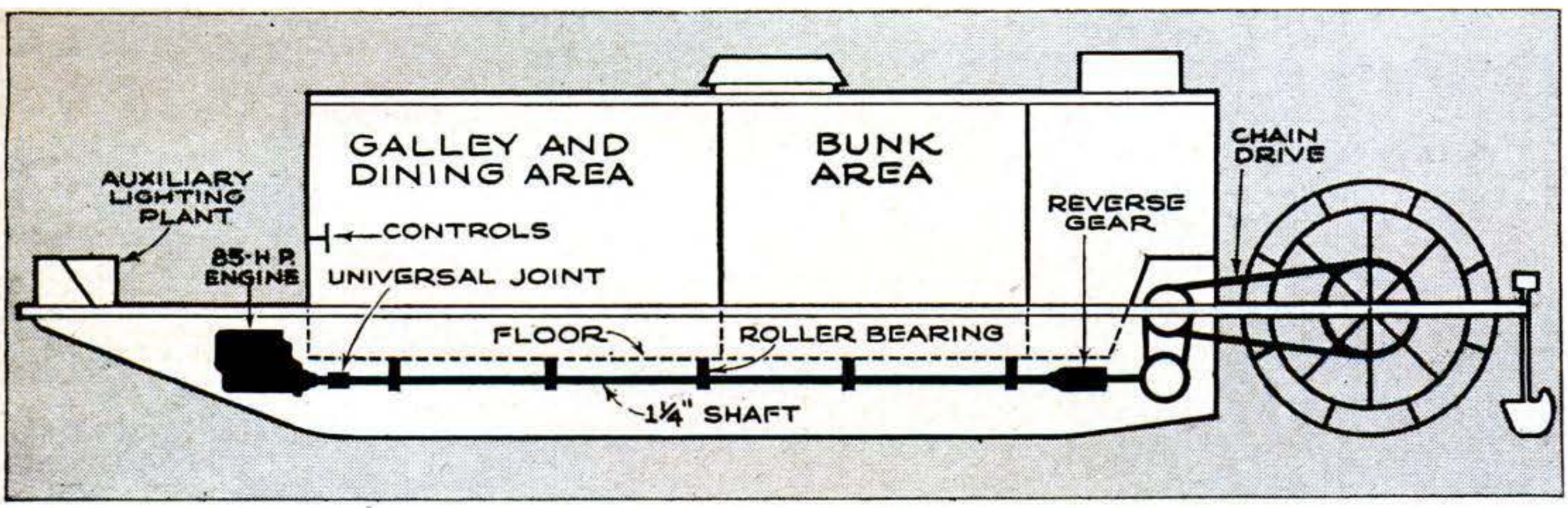
Homemade stern-wheeler powered by 85-horse auto engine takes its mechanic owner for summer vacation cruises.

NOW that spring is here, people along the inland waterways of Wisconsin can soon expect to see the Ark of Oshkosh. As boats go, the 40-foot Ark isn't especially pretty. But Skipper Frank Percey will argue that his is one of the most serviceable little crafts ever built.



HULL was built upside down. Framing is oak, planking 1⅜" pine sealed with cotton wicking, roof cement and tar-thickened creosote. Hull is 32′ long and 10′ wide.

A mechanic and electrician by trade, Skipper Percey never had tried his hand at boat building until he began the Ark. Launched two years later, the paddle boat has carried him on numerous vacation trips since then. The original construction has proved sound. Only one major change has been made. The engine, an 85-hp. Ford V-8 with a water-jacketed oil cooler, was moved from rear to front to give the craft better balance.



INSIDE THE ARK, you find four bunks aft. Dinette, galley, wheel and engine controls are in forward cabin. The wheel operates twin rudders through a chain and car steering gear. A remote-control solenoid works the engine starter. The reverse and forward gear, located at rear of drive shaft, shifts by cable from pilot position in cabin.

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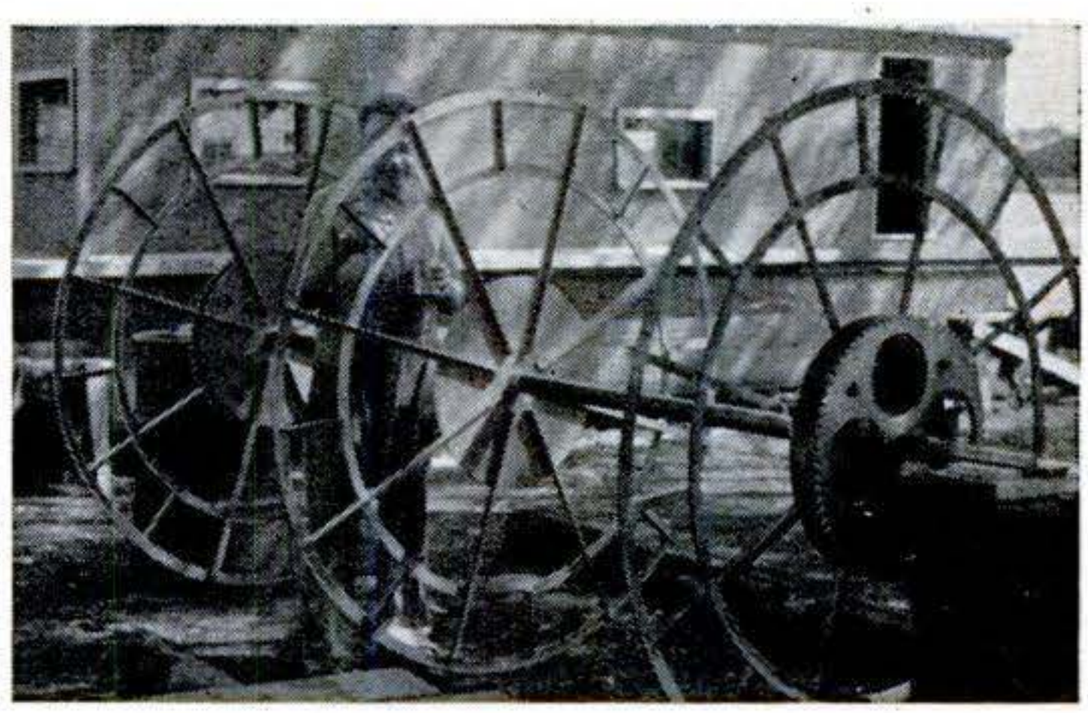
The engine has a cooling tank instead of a radiator. An extra pump, belt-driven off the drive shaft, forces cooling-system water through a set of heat-transfer coils that were made of ¾″ pipe and located outside the boat.

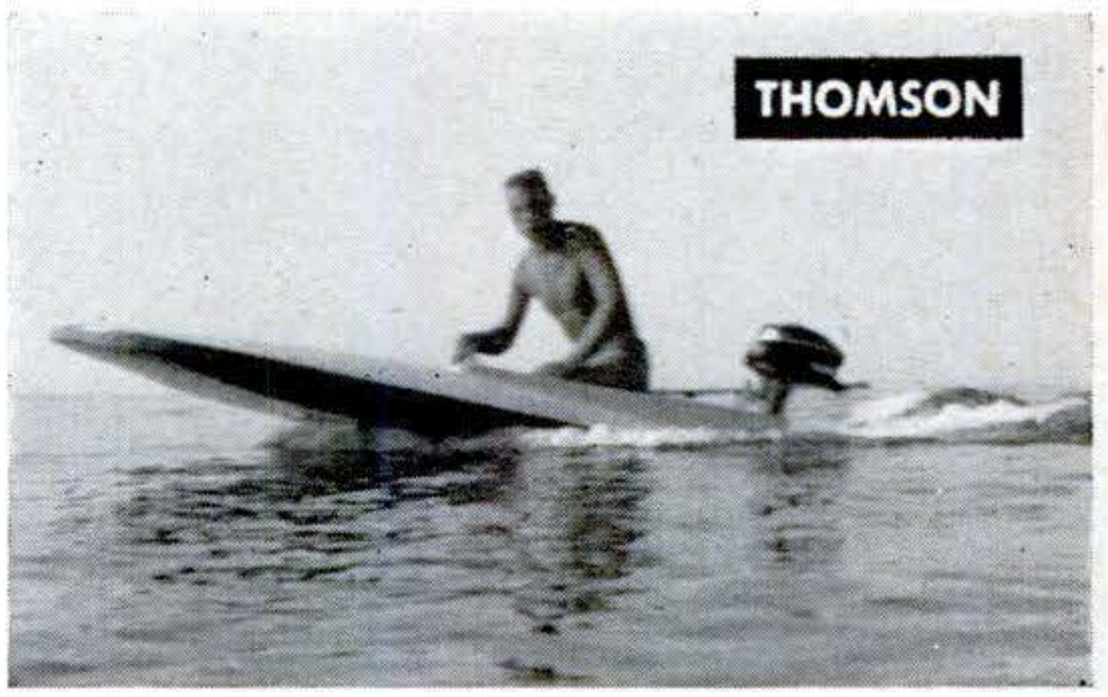
A 17′ drive shaft rides in five bearings. The drive carries through two chain-connected car differentials, one mounted above the other. At the ends of jackshafts extending out from the top one, chains run to the paddle wheel.

The Ark travels at a speed of about 10 miles an hour. Its weight is around 6¾ tons.



PADDLE-WHEEL FRAME consists of band iron formed into circles and welded to angle-iron spokes. Wheel has 16 paddles; diameter is 5½′, length 9½′. Hollow shaft cuts weight.

PSM "Flying Saucer" Design Launches Many Racing Hulls

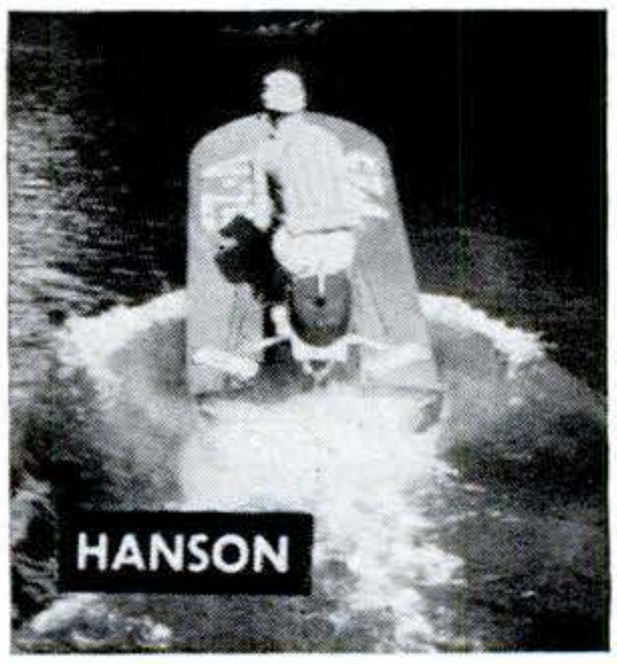


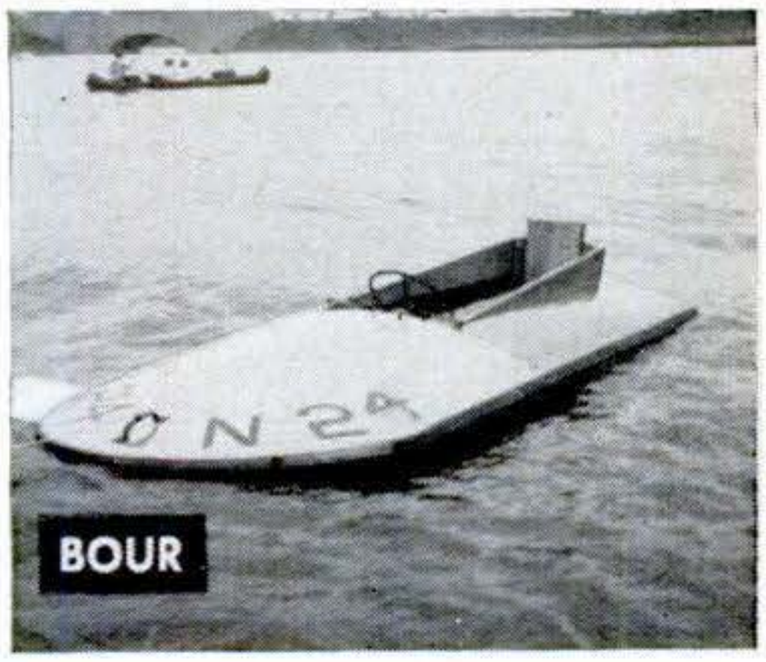
A LOT of hammering, sawing, drilling and planing disturbed the quiet of many a waterside last summer and fall, and here are some of the results. These racing hulls have given their builders plenty of speed and fun. All are offshoots of the Flying Saucer, the snappy little racer that POPULAR SCIENCE MONTHLY described in detail in February, 1951 (p. 226).

Instead of the 7½-hp. Mercury that John Rogers used on the original Saucer, Randal Berardi of Pekin, Ill., used a 10-hp. Super Hurricane. "I haven't been passed yet," Berardi writes, "but I expect to be next summer. Four other fellows are building boats and plan to use the same engine."

John Dietrich, 14 years old, of Los Angeles, says that he found construction a cinch because of the "very complete plans and pictures." Bob and Joe Thomson of Hollis, N. Y., tried out a 3-hp. engine and found their craft would make a respectable speed even at this low power.

Frank Hanson of Madison, Wis., built his craft 27″ longer than the original, used a 10-hp. Mercury, and finds he can hit close to 40 m.p.h. With the help of two friends, James L. Bour of St. Paul completed the job in nine evenings' work at a cost of $22.50.





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Current Events Date Photos

Linking baby snaps to the day's news makes pictures mean more later.

By Irving Desfor

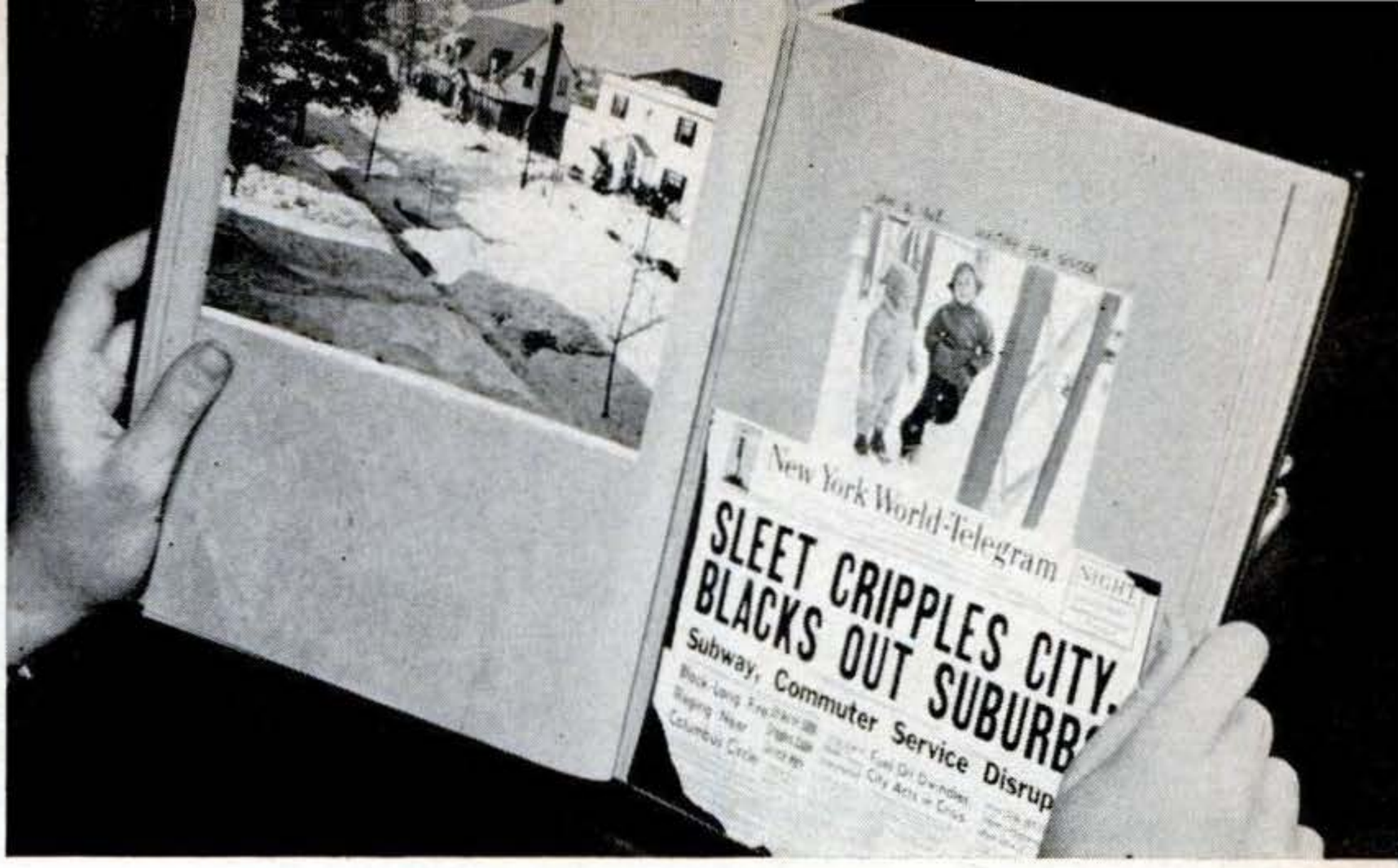
NEWSPAPER headlines tell the story of what's happening in the world each time you shoot a batch of family photos. So why not combine the two?

Pasted down in the album, a newspaper front page effectively dates the photos and presents them in relation to the moment in history when they were snapped. With the passing of time, a headline album steadily increases in interest and value.

For the best display, the album should be at least 9″ by 11″. As for the newspaper,

A PEACEFUL VISIT TO THE ZOO contrasts with same day's war news from across the sea.

A small photo copy of full news page makes good reading in later years.



BLIZZARD BABY. Here is how the Desfors recorded the arrival of baby Phyllis, born in the midst of the 1947 blizzard. Shown waiting for sister are Barbara and Susan (right). For how the children now enjoy the headline albums, see the facing page.

all you need is the top part of page one. Cut it about 10½″ from the upper edge and you can spread it across two pages of a 9″ by 11″ album. Sometimes it is best to make a smaller photo copy of the page. It will last longer than the newsprint, which yellows with age, and occupies less space.

Rubber cement makes a clean, flat, permanent job on both prints and newspapers. Apply thin coats on the print back and album face and let the cement dry a minute before pressing down the print.

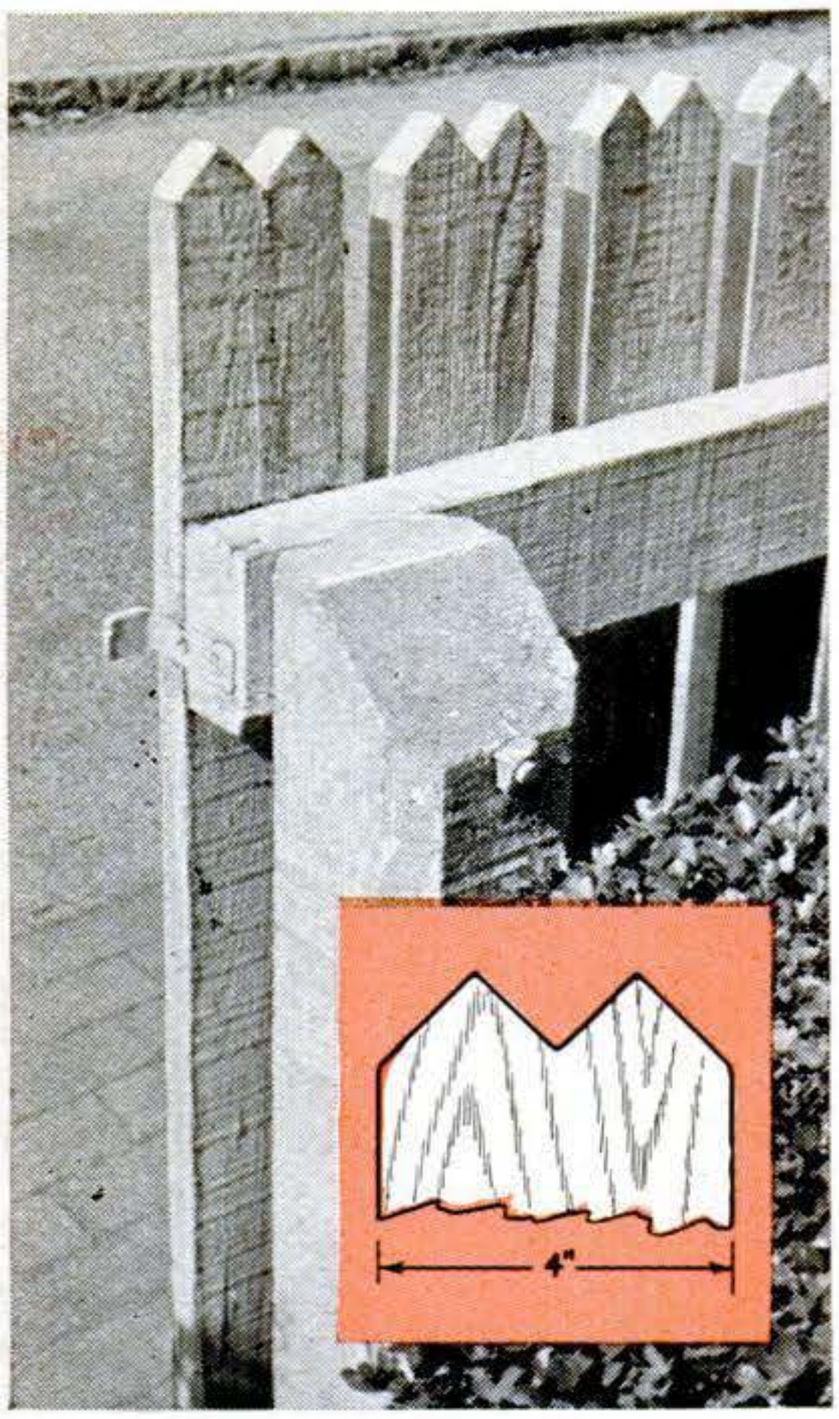
THE REAL WINNER in the Desfor home the day La Guardia was elected to a third term was little Susan. The Desfors keep a separate album for each of their children.

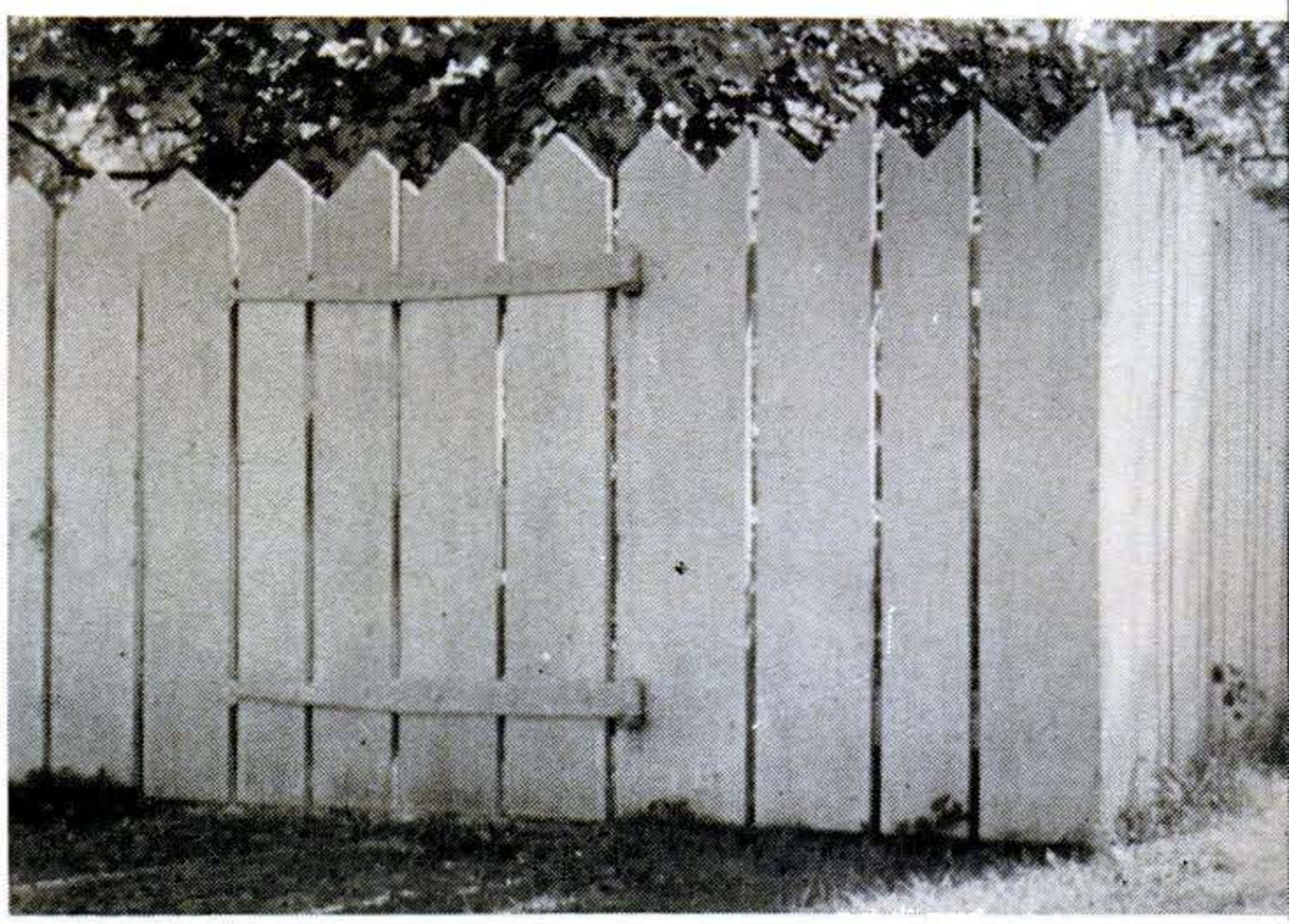
New Ideas from Old Fences

Here are 10 classic examples of Colonial fences that you can adapt or duplicate to enclose your own yard.

IF YOU had lived in Williamsburg, Va., a couple of hundred years ago you would have had a fence around your property whether you liked it or not. Or else you could have been tossed in the pokey by the Colonial constables. Fencing was required by law in eighteenth-century Williamsburg—mainly to keep cows out of the gardens.

Today, Williamsburg is still loaded with fences—several miles of reproductions of Colonial designs. Some are plain, some as fancy as the latticed and paneled gate above.





PICKETS CAN BE WIDE, as fence of random-width boards (above) shows. A fence like this one gives a screening effect. Note the design variation in picket tops.

DOUBLE-POINTED PICKETS (left) need four saw cuts. Concrete posts, now used extensively in Williamsburg because of termites, make fence more permanent.

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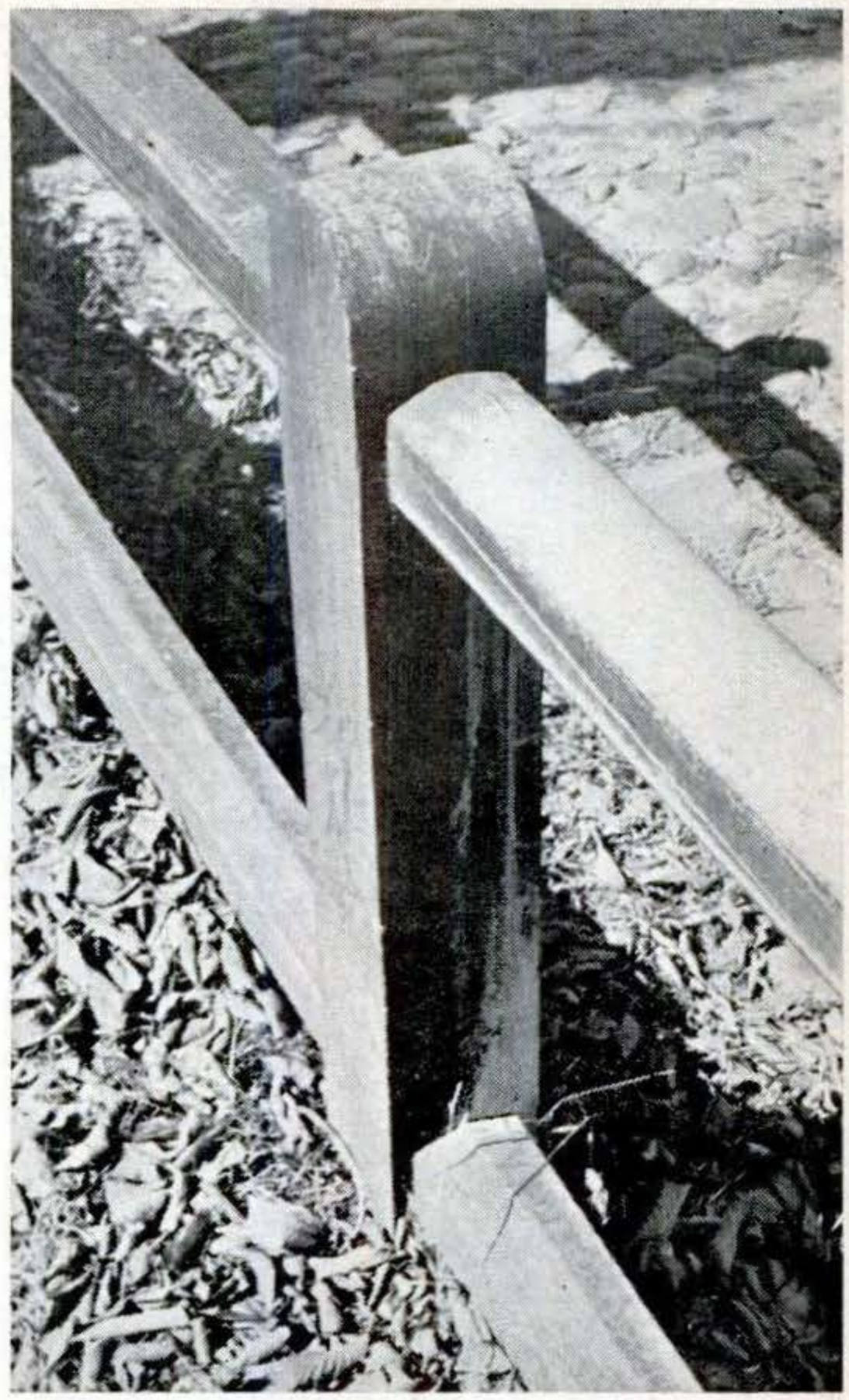
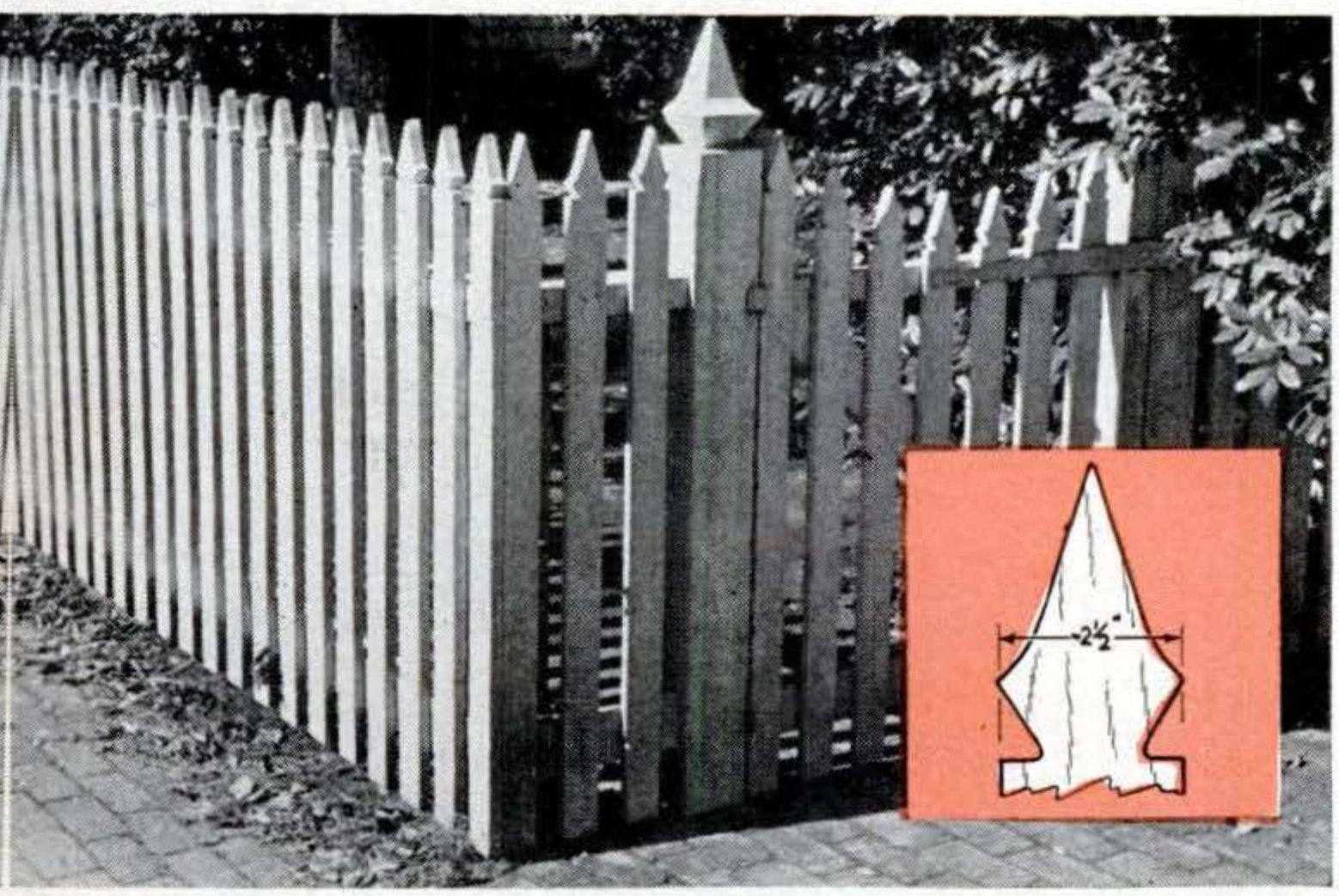
HEART-SHAPED TIPS are easily cut out on a bandsaw. Half a dozen pickets can be stacked and pattern-sawed at once. Note H hinges.

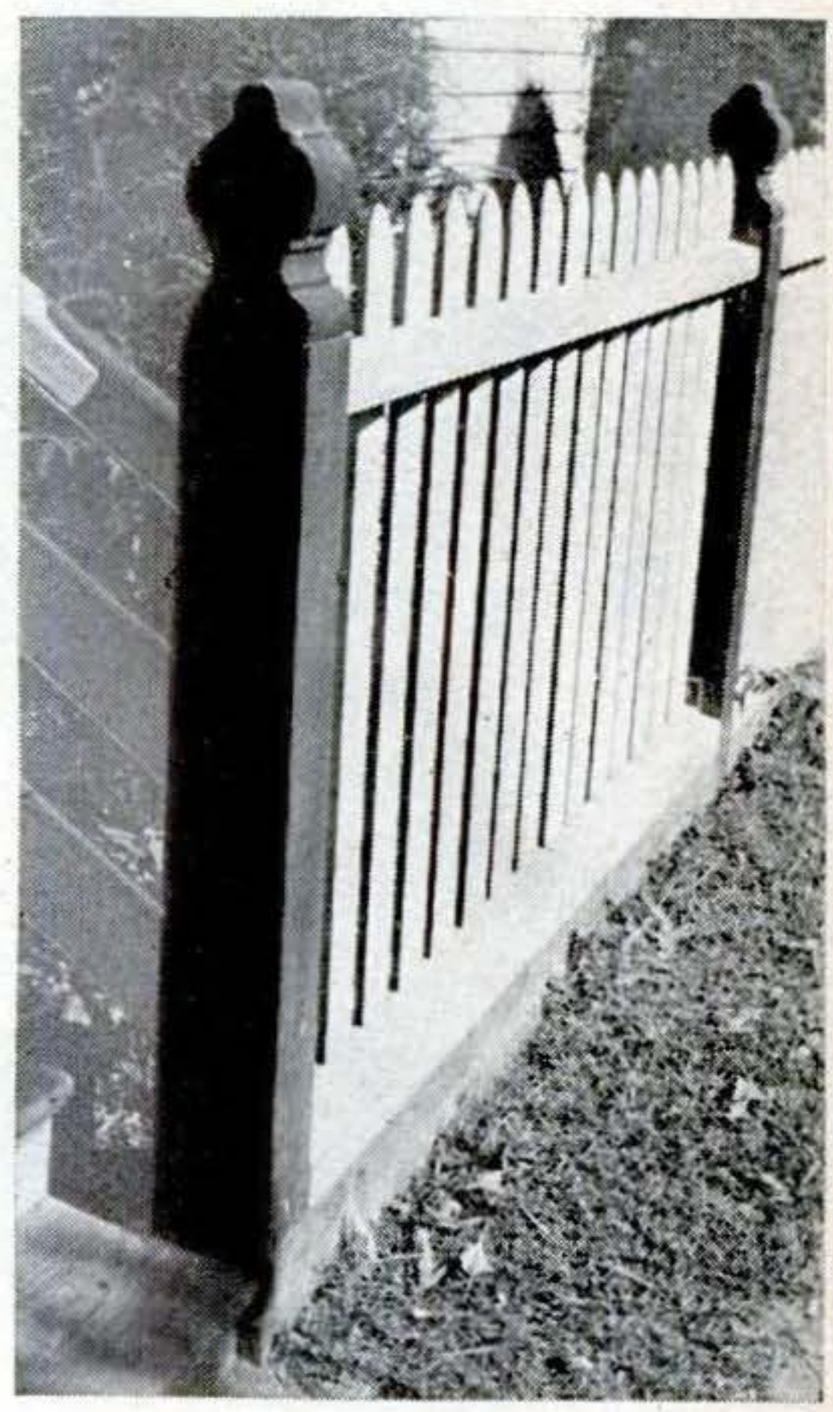
Hand tools and, in some cases, plain hard labor were employed to make the original fence. With a bandsaw or circular saw you can turn out duplicates at a fraction of the effort the old-timers put in.—*Walter E. Burton, Akron.*



HITCHING FENCES usually were in front of taverns, churches and other public buildings. Purely decorative, they won't stop kids.



CHURCH-STEEPLE DESIGN (above) can be cut on a bandsaw or jigsaw. Pointed top of post was shaped separately and then joined to post with a heavy dowel.



ROUNDED POINTS on pickets like these (right) can be rough-sawed and then shaped on belt or disk sander or with rasp. Pickets are white, posts brown.

Please turn the page for more fence designs.

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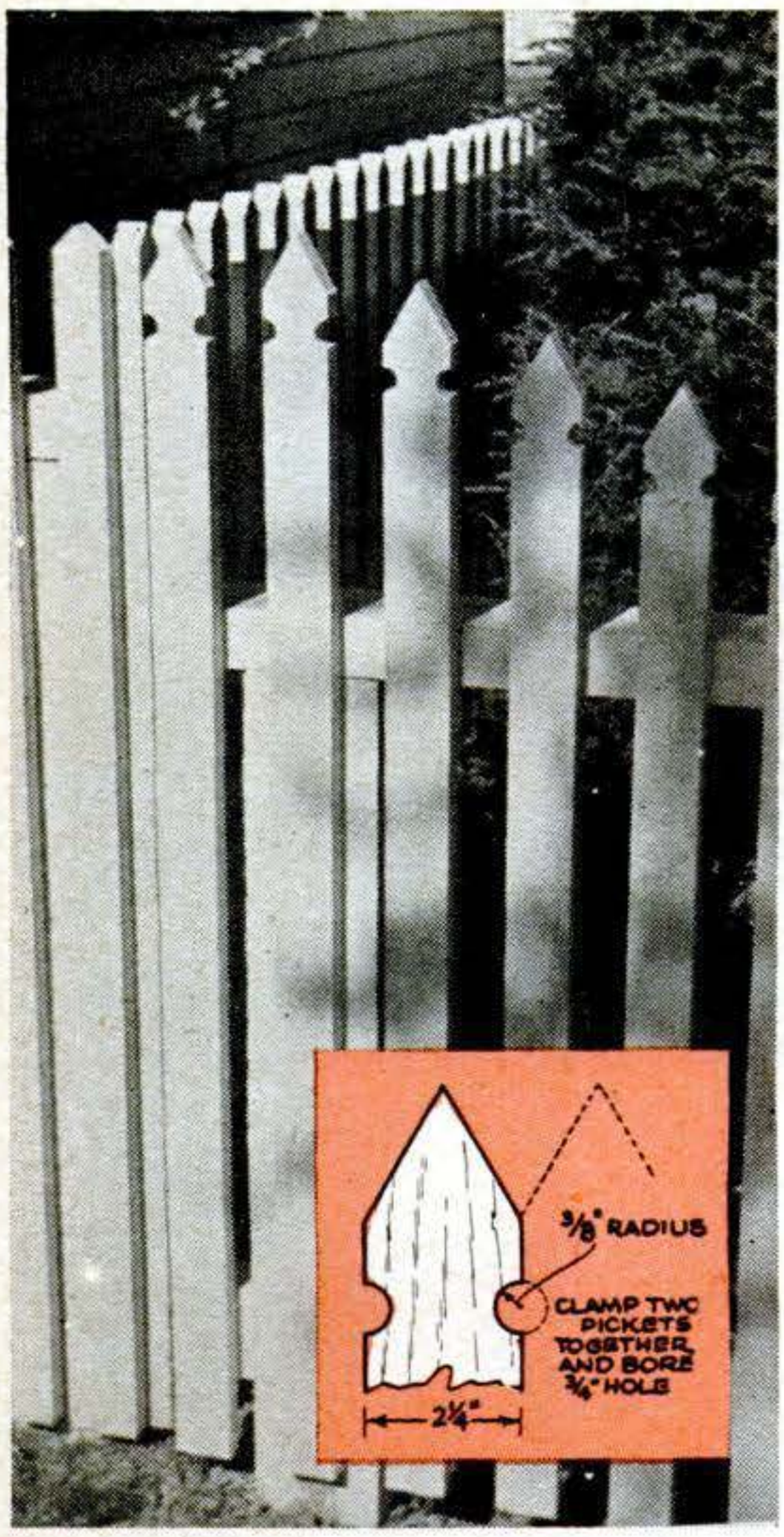
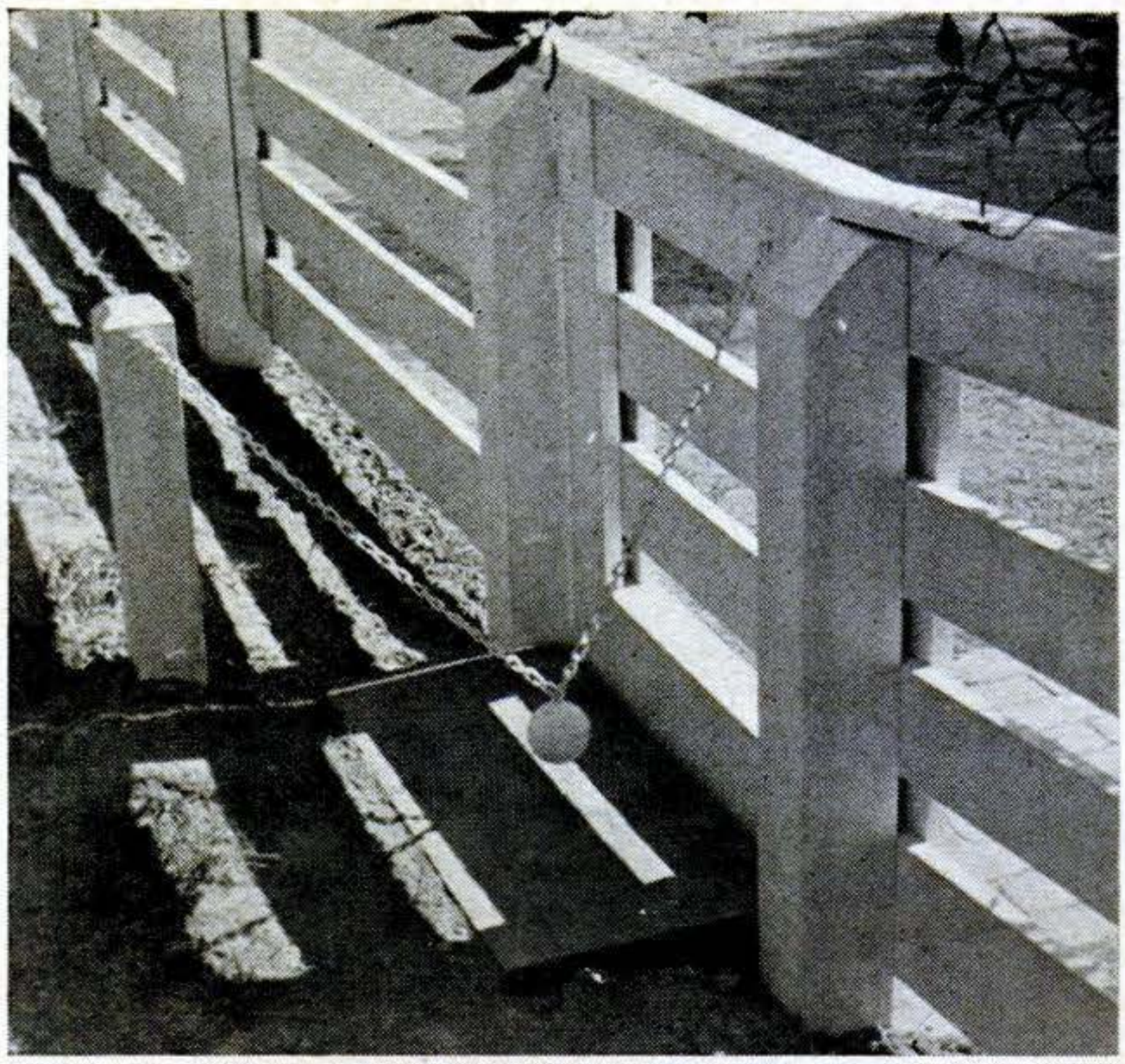
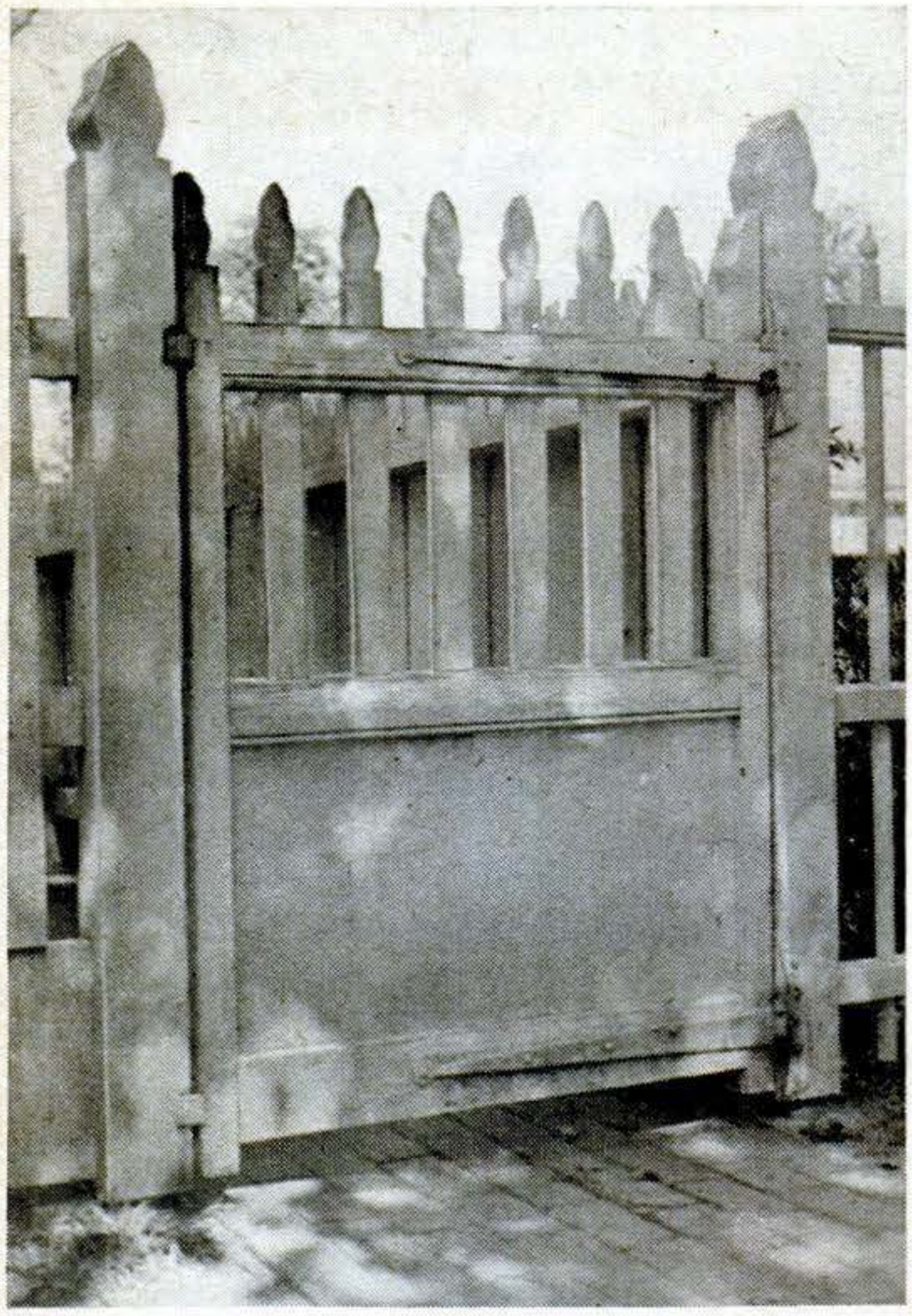


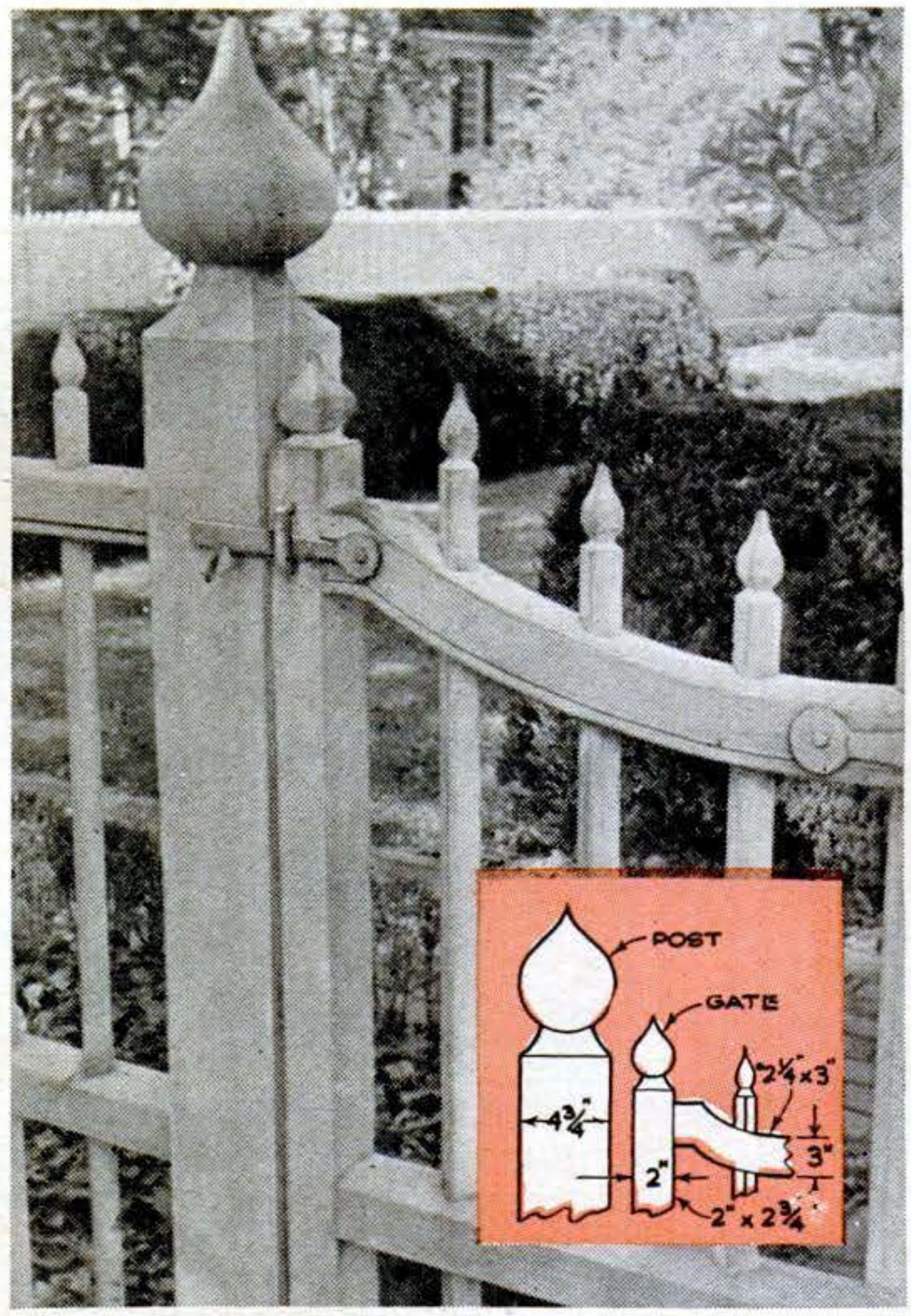


PLANK FENCE (above) has rounded handrail on top. The self-closing ball-and-chain setup is an old-time stunt that you can adapt to an outward-swinging gate.

EDGE NOTCHES in pointed pickets (left) were made by clamping pickets edge to edge and drilling hole on line of contact. Square notches can be sawed.



CANDLE FLAMES are simulated by the tops of these gate pickets and posts. Pattern-sawing on a bandsaw or jigsaw cuts them fast.



SQUARE PICKETS WITH FLAGPOLE TIPS are set with sides at 45° to edges of rails. Split rails with sawed V notches will hold them.

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How to Glamorize Picture Frames

A professional framemaker shows you the way he builds de luxe frames that combine lacy texture and a two-color effect.

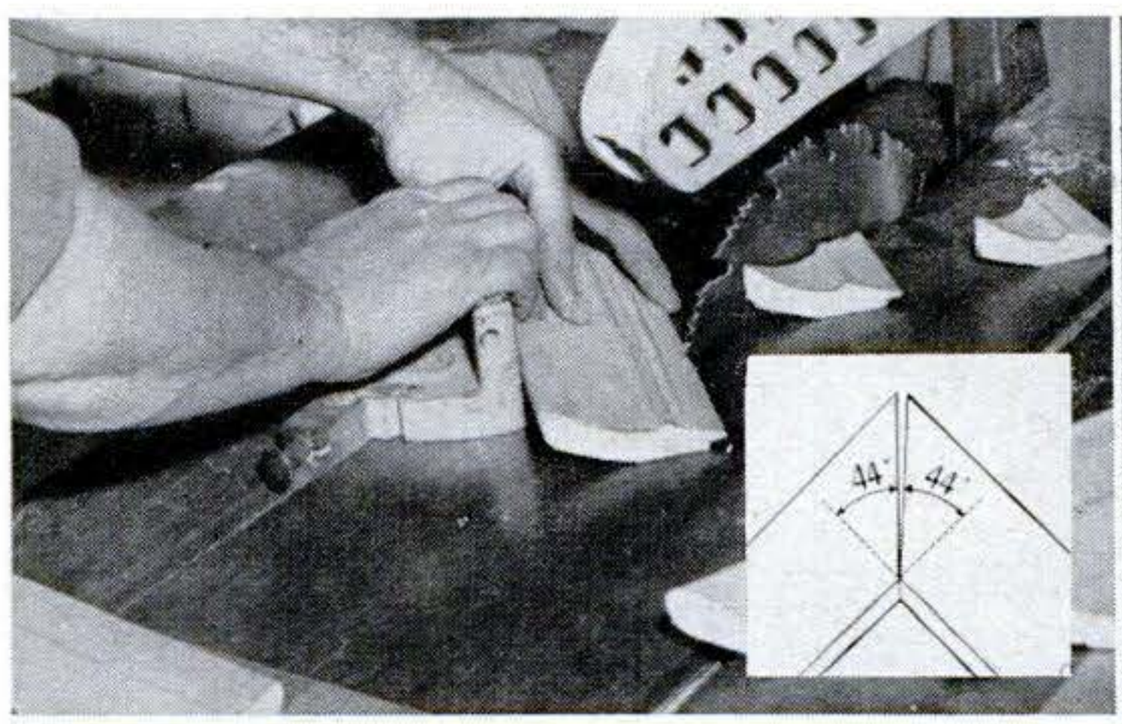
LACE and paint give this modern frame rich texture and highlights of color that attract the eye without stealing attention from the picture inside.

New York framemaker Ben Lewensohn made the cloth-on-wood picture setting and shows in these photos how he did it. You can use his simple method to build colorful new frames or add glamor to old ones.

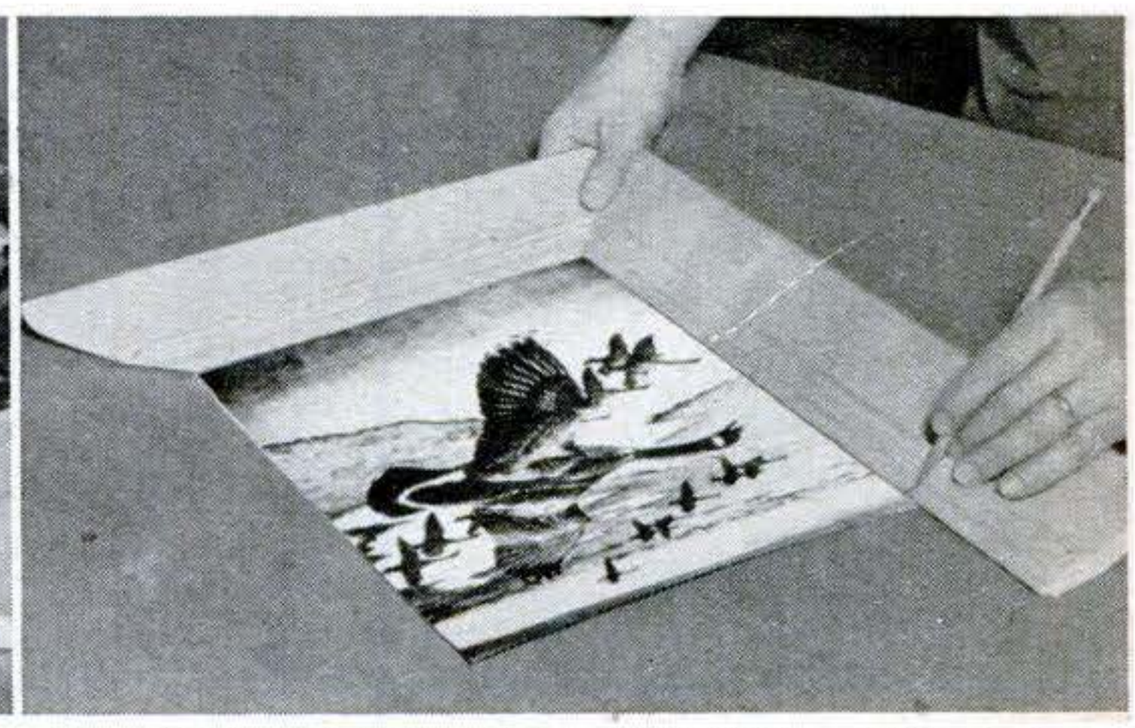
If you start from scratch, you will need a length of molding. Ready-made picture-frame moldings with rabbeted edges are available in many shapes and sizes. You can use regular trim molding, bought in a lumberyard, if you rabbet an edge ¼″ by ¼″.

The frame. Cut four strips of molding the length of the picture dimensions plus twice the width of molding. For

A LACE INLAY turns an ordinary frame into a modern picture showcase that can set off any print, painting or photograph.



1 SET THE TABLE-SAW GAUGE at 46° and feed inner edge of molding into blade to produce the 44° angle shown in inset. If you saw by hand, measure angles carefully.



2 MITER BOTTOM AND ONE SIDE and fit picture into rabbet. Mark each piece for length, allowing for depth of rabbet. Cut top and other side to match first pair.

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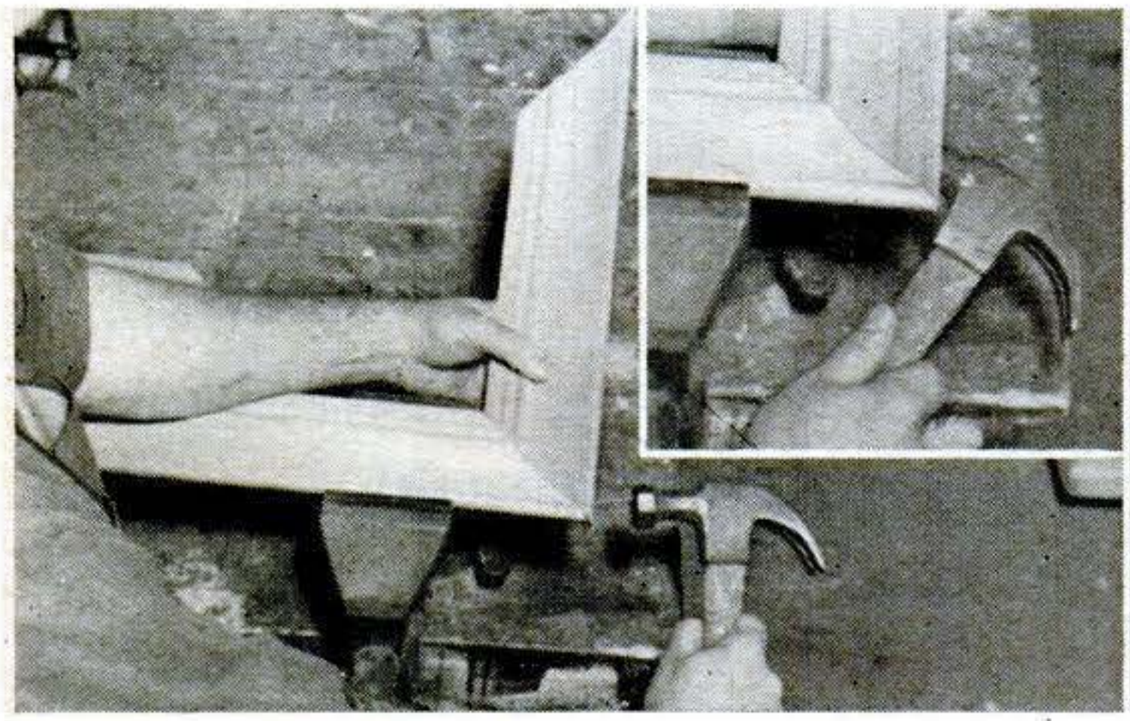
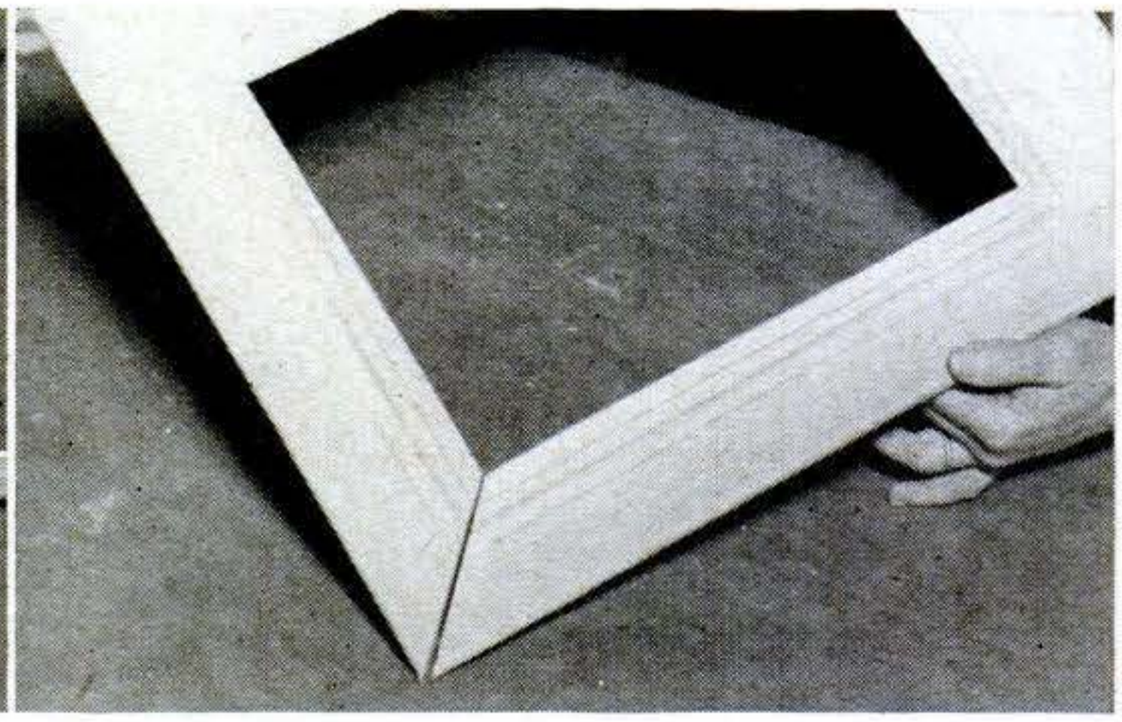
example, to frame an 8″ by 10″ picture with 2″ molding you need two 12″ and two 14″ lengths. If you use a mat, use its dimensions in place of the picture's.

You can get different textured effects by selecting lace of suitable pattern or by substituting cheesecloth, gauze, burlap, or monk's cloth. If you use one of the heavier fabrics, tamp it down with an extra coat of primer paint.

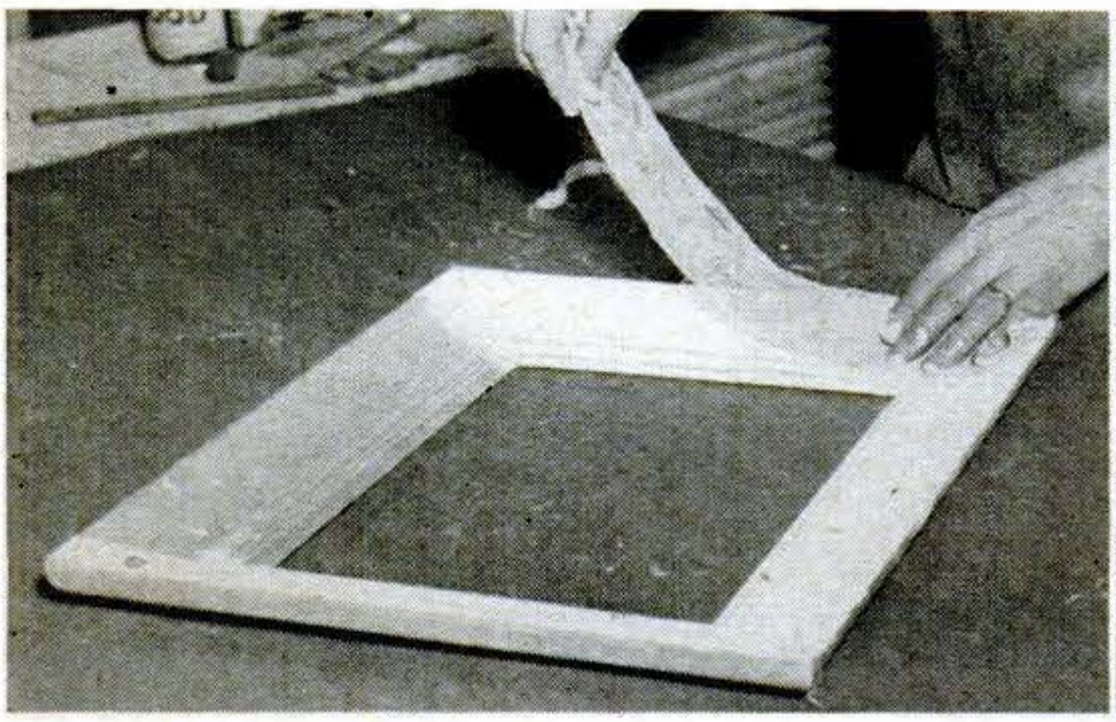
Use contrasting colors—such as red and black or dark blue—to highlight the cloth. The final coat tones down the colors. If you want to bring up more color after the last coat is dry, steel-wool it lightly.—*Gene Liberty, The Bronx, N. Y.*



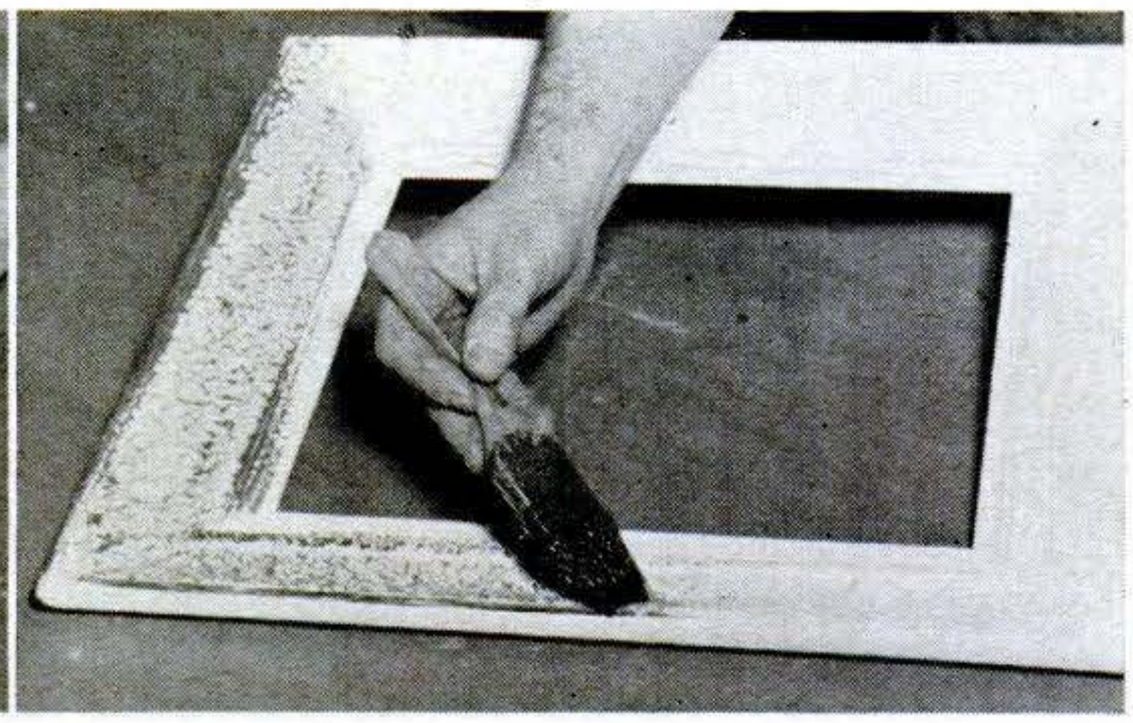
3 NAIL AND GLUE the corners. Clamp one piece in a vise, square corner, and drill nail holes. In final assembly let free end overhang corner 1/8″; nailing will even it up (inset).



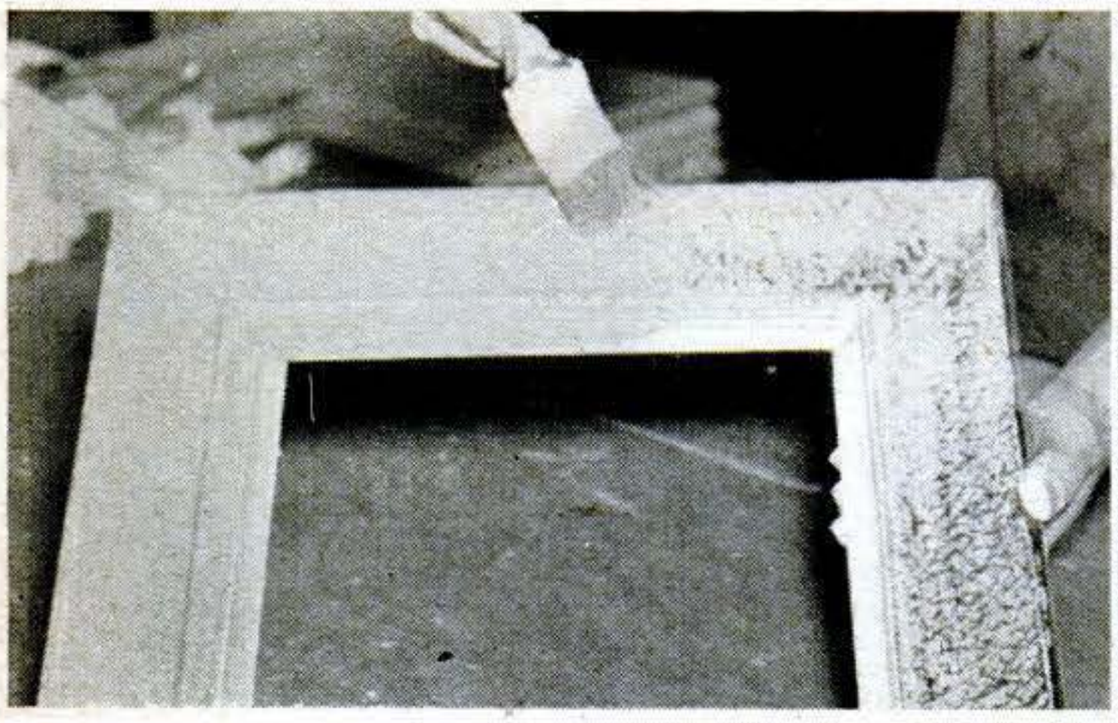
4 OPEN END of last corner is caused by 44° miter. When this corner is glued and nailed, the frame will be tight and square and will get tighter as the wood dries.



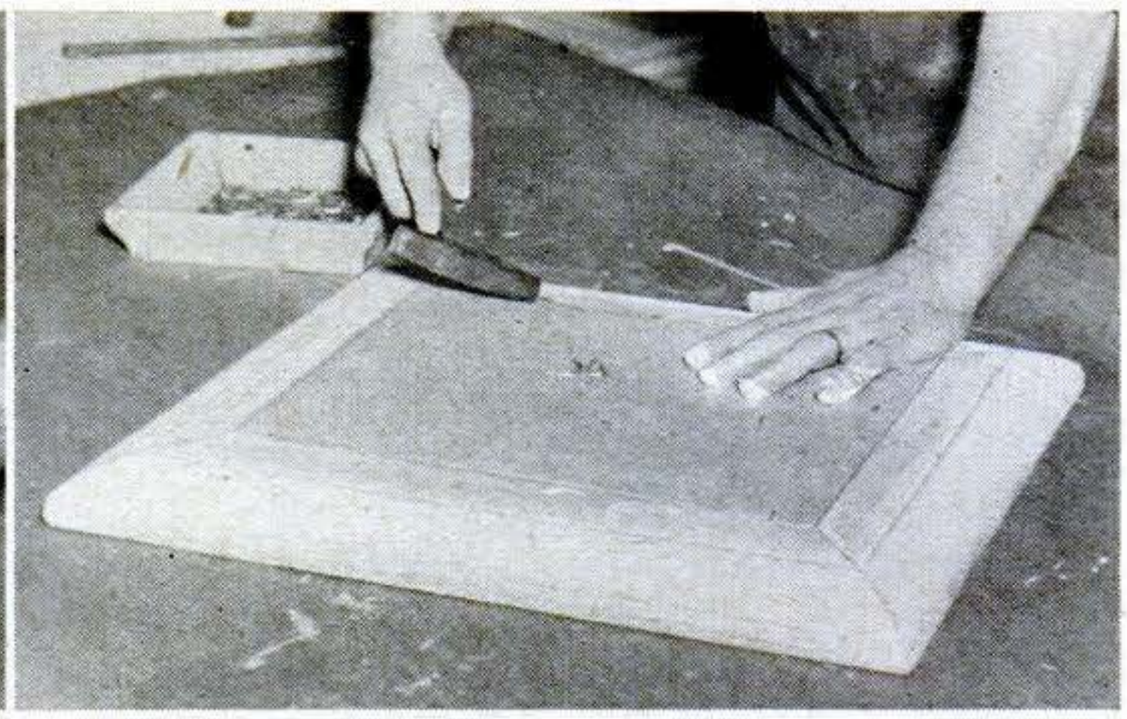
5 FLAT PRIMING PAINT acts as adhesive for lace inlay. Spread strips of lace on wet paint, press them to shape of wood and trim edges and miters. Let dry thoroughly.



6 MOTTLE LACE WITH RED PAINT. Use a light touch and an almost-dry brush. Let the red dry and add a few streaks of black. When dry, shellac the frame.



7 TONE DOWN COLOR STREAKS with thin coat of flat gray paint. While final coat is still wet, rub it gently with a cloth to bring out high spots of lace and undercolor.



8 BRAD THE PICTURE and a cardboard backing into the frame rabbet. Color-toned frame makes an especially good border for a fine black-and-white photograph.

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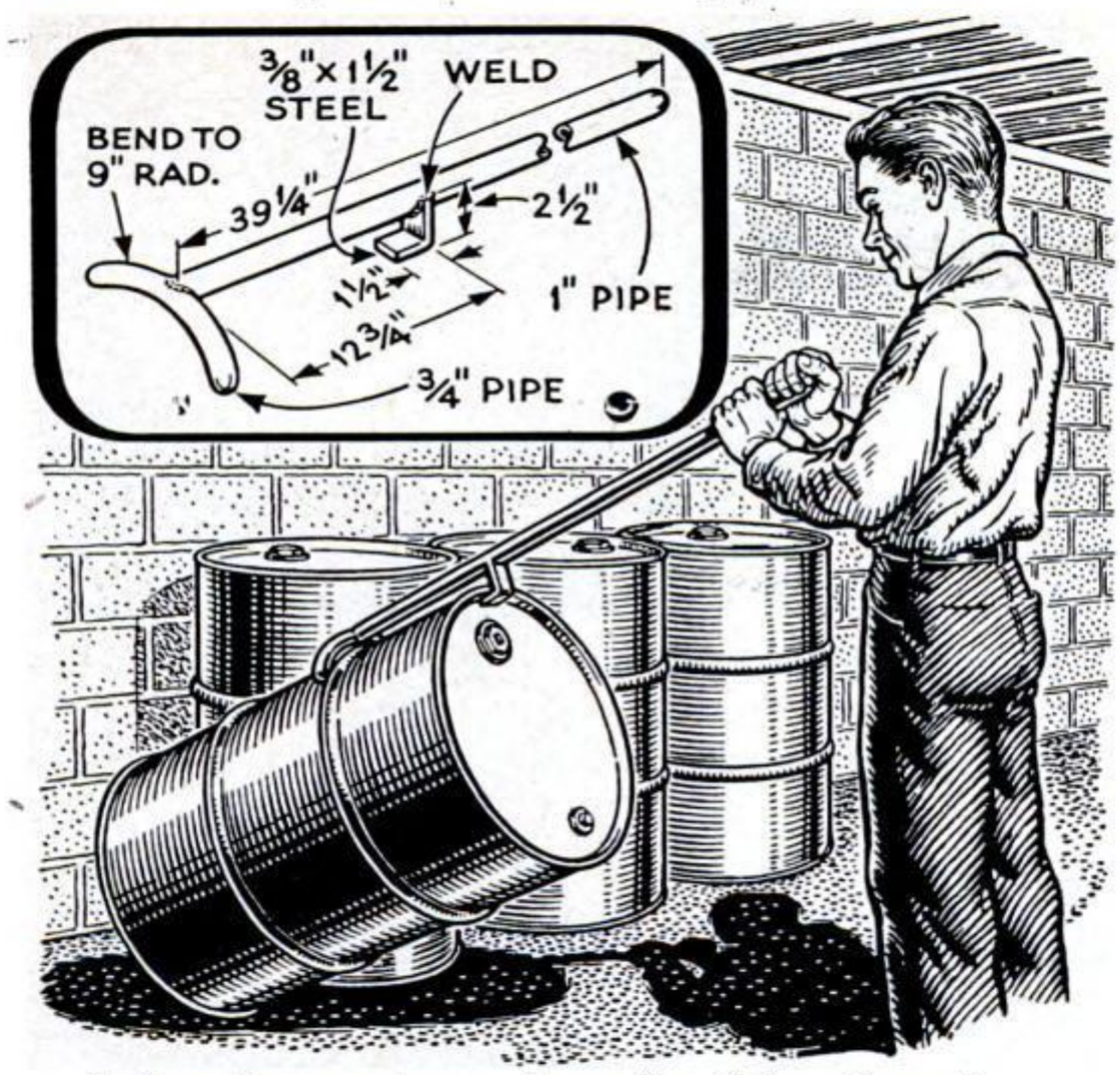
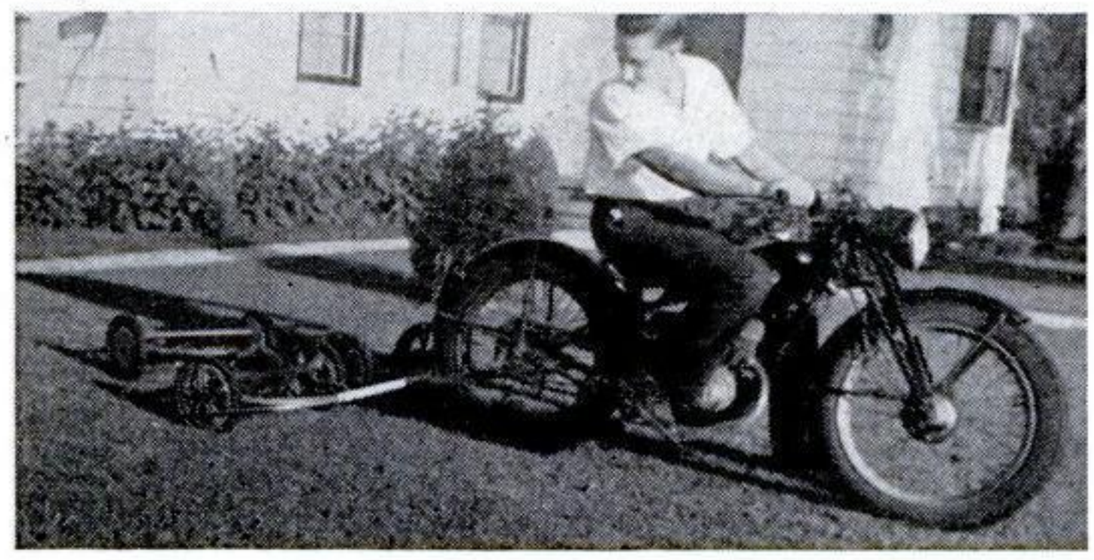
Lever Upends Heavy Drums



It's a lot easier to handle 55-gallon drums with this simple tool. The welded hook is spaced so that the bent yoke will strike the drum just below the first rib, keeping the tool from slipping while you lift.—*K. Heryford, Cedarville, Calif.*

Cycle Makes Lawn Trim Easy

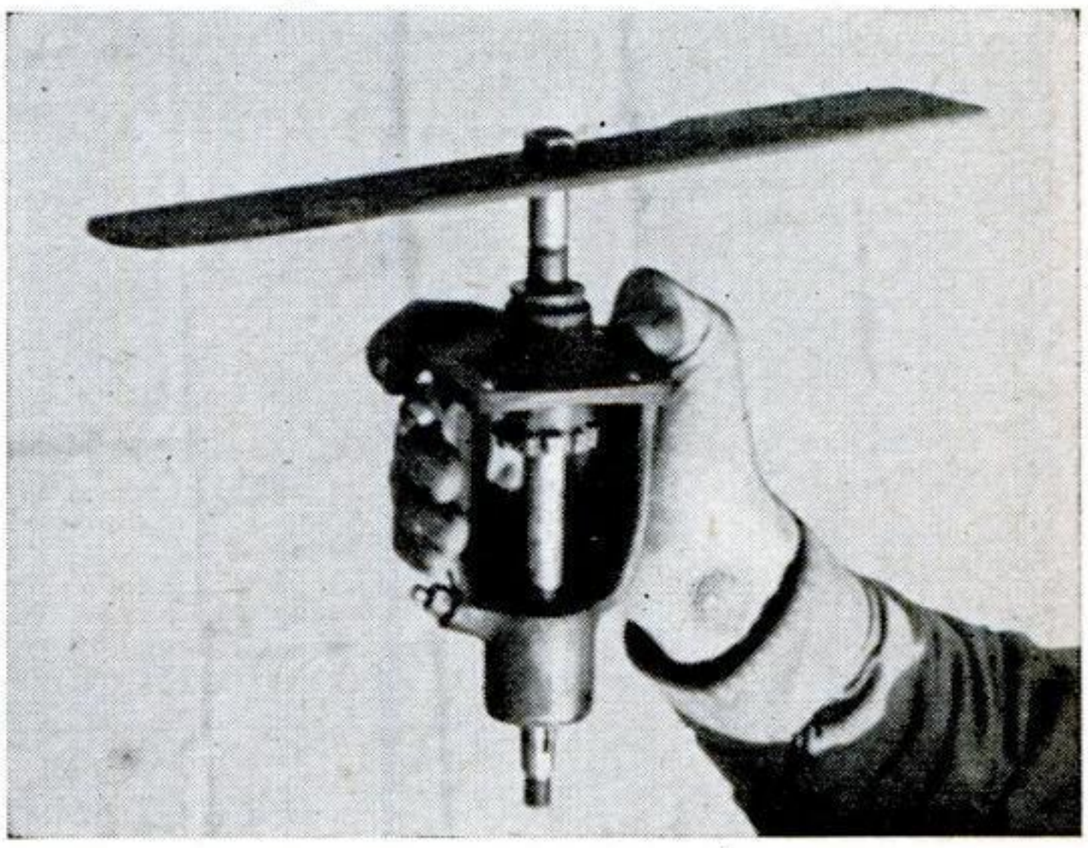


Lawn shaving is a sit-down job for George Samuelson of East Peoria, Ill. He harnesses three hand mowers—less handles—behind his light Harley-Davidson when he trims his large lawn. A job that used to take 3½ hours is now done in 25 minutes.

Neat Coasters Cut from Cans

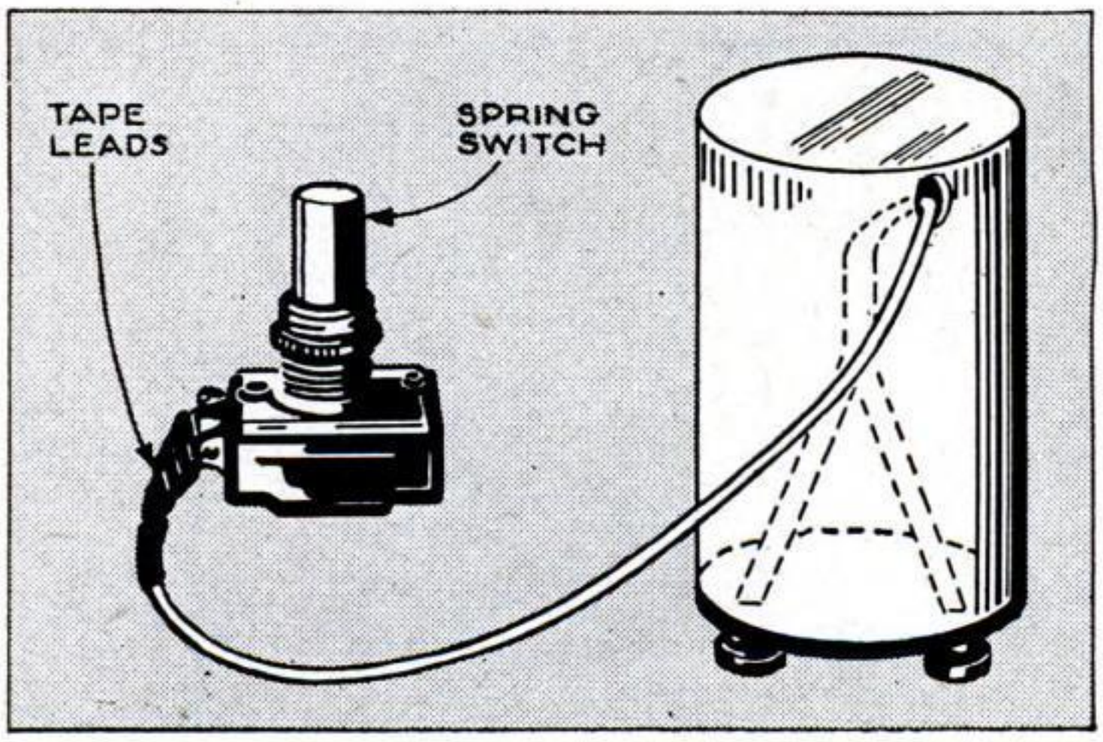
A set of coasters, both practical and decorative, are easily made from ends cut from coffee or other cans. Remove them with a gear-type opener so the edges will be even. Crimp a pattern around the edge of each one with a pair of sharp-nosed pliers or other suitable tool. A coat of bright enamel, or perhaps decals protected with a coat of lacquer, will put them in the store-bought class.—*Louis Hochman, Sherman Oaks, Calif.*

Old Pump Used in Mower



When he needed a bearing assembly for a homemade rotary mower, Lloyd Marler of Garden City, Mo., used the casting and bearings from an old Model A water pump. It's easily bolted to the upper platform of the mower with the lower part of the shaft projecting below for the mower blade. The V pulley is fitted to the top of the shaft.

Dummy Starter Hunts Trouble in Fluorescent Lights



When a fluorescent lamp doesn't light, either the lamp or the starter may be at fault. Instead of changing both to find the trouble, use this dummy starter. Remove the insides from a discarded starter, drill a hole near the top of the shell and wire the contacts to a normally open spring switch.

Insert the tester in the dead fixture. If the lamp ends glow when you close the switch, the old starter is defective and should be replaced.

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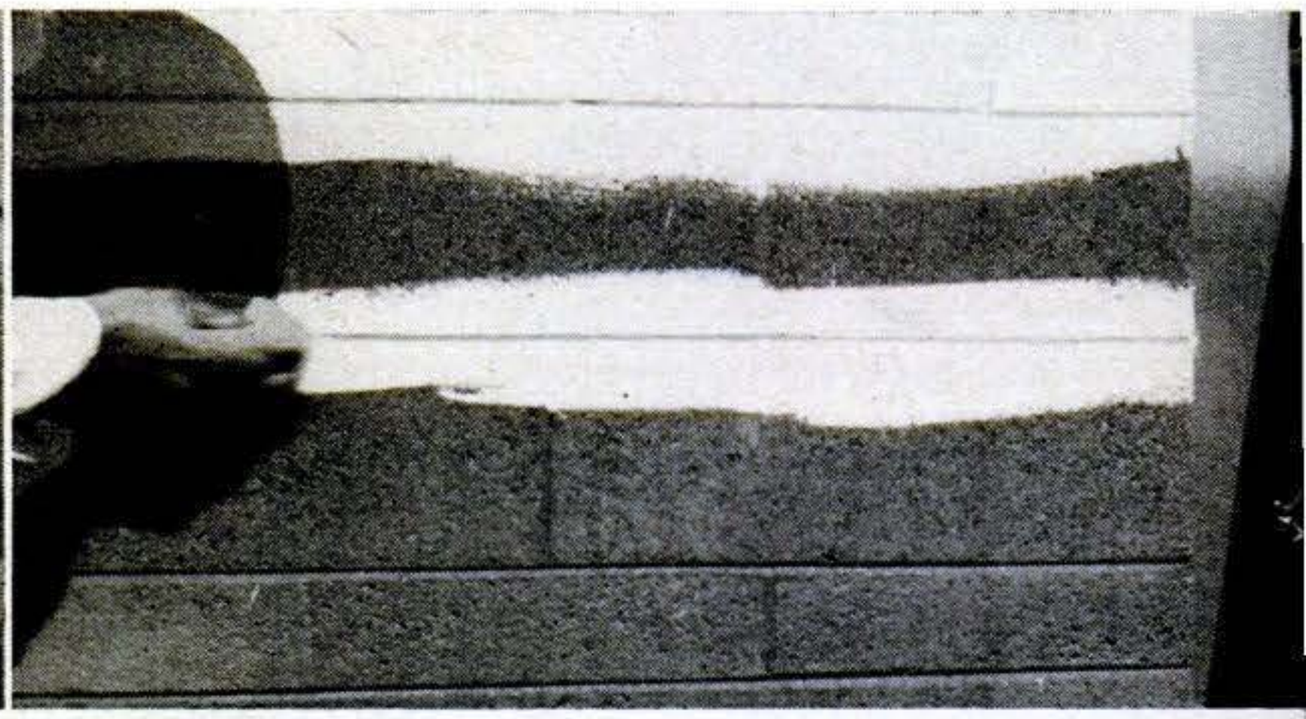
How to Paint Concrete Walls

With water-mix paint, you just scrub it in with a stiff-bristled brush. The results look slick.

1 MEASURING. Water and powder should be measured carefully to proportions specified. Wear rubber gloves if skin is sensitive.

4 BRUSHING. Use brush with short, stiff bristles like a scrub brush. Paintbrushes are too soft to force paint into pores.



5 FILLING JOINTS. In applying this Portland-cement paint on a cement-block wall, first scrub paint into mortar joints.

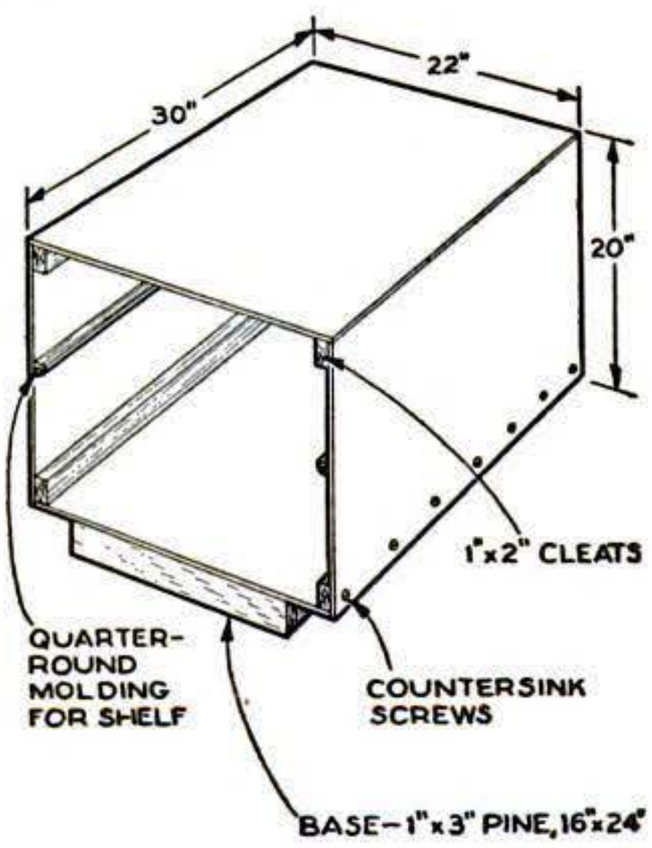
THERE are two reasons—both of them good—for painting concrete walls. It improves the looks 100 percent and, with the right paint, weatherproofs them as well. Four common types of concrete paints are:

Cement base. Low cost and ease of application make this kind attractive. It comes as powder that is to be mixed with water. Don't apply this type over oil paints, calcimine, whitewash or grease; over walls that contain frost; when the temperature is below 40°; or over magnesite stucco. This is the paint being used in the photos.

Cement-metallic base. Also a powder that is mixed with water, this mixture seeps into the pores of the wall and expands,

Sections of Bamboo Rug Pole Dress Up End Table

PANELS of ¼" hard composition board are easily joined with wooden cleats to build this useful end table. Its box-like construction provides ample room for magazines and books. Half-round strips of bamboo, cut from a rug pole, contrast with the finish that I used—dark green enamel—and also conceal the cleats and shelf supports.—*Donald Hanauer, Prospect Heights, Ill.*



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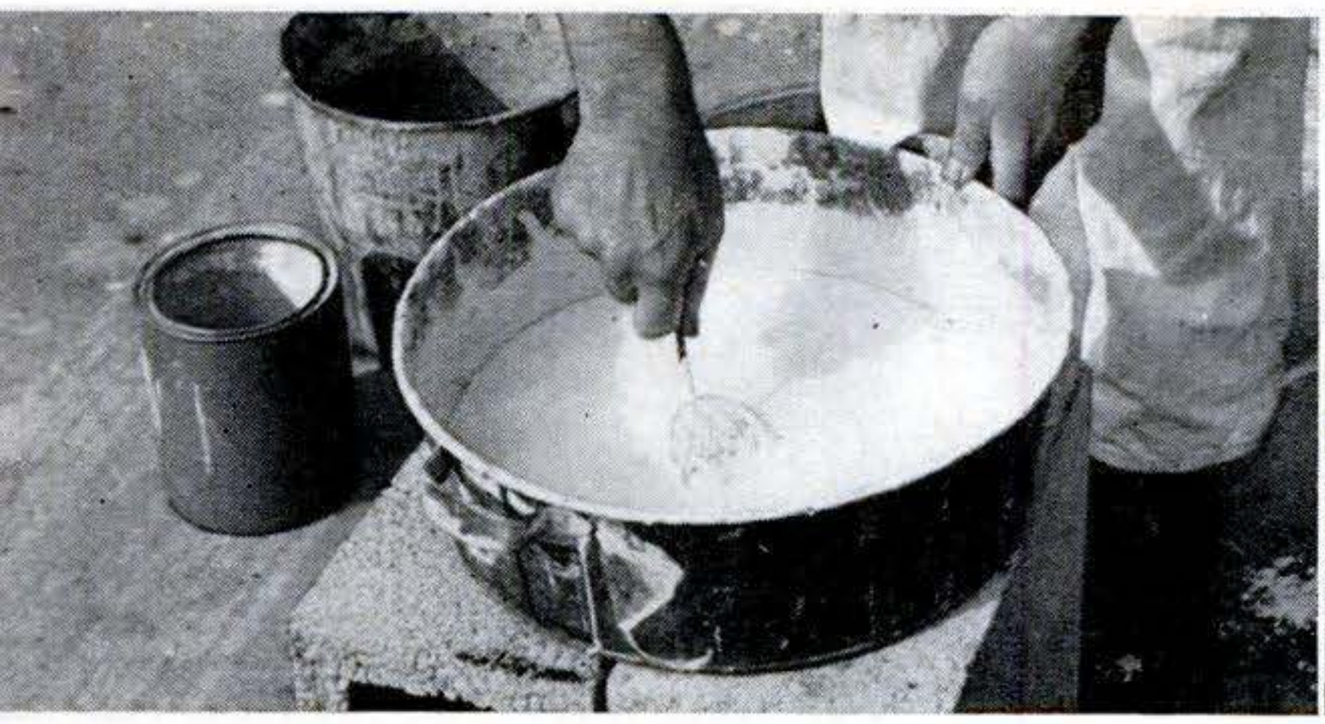
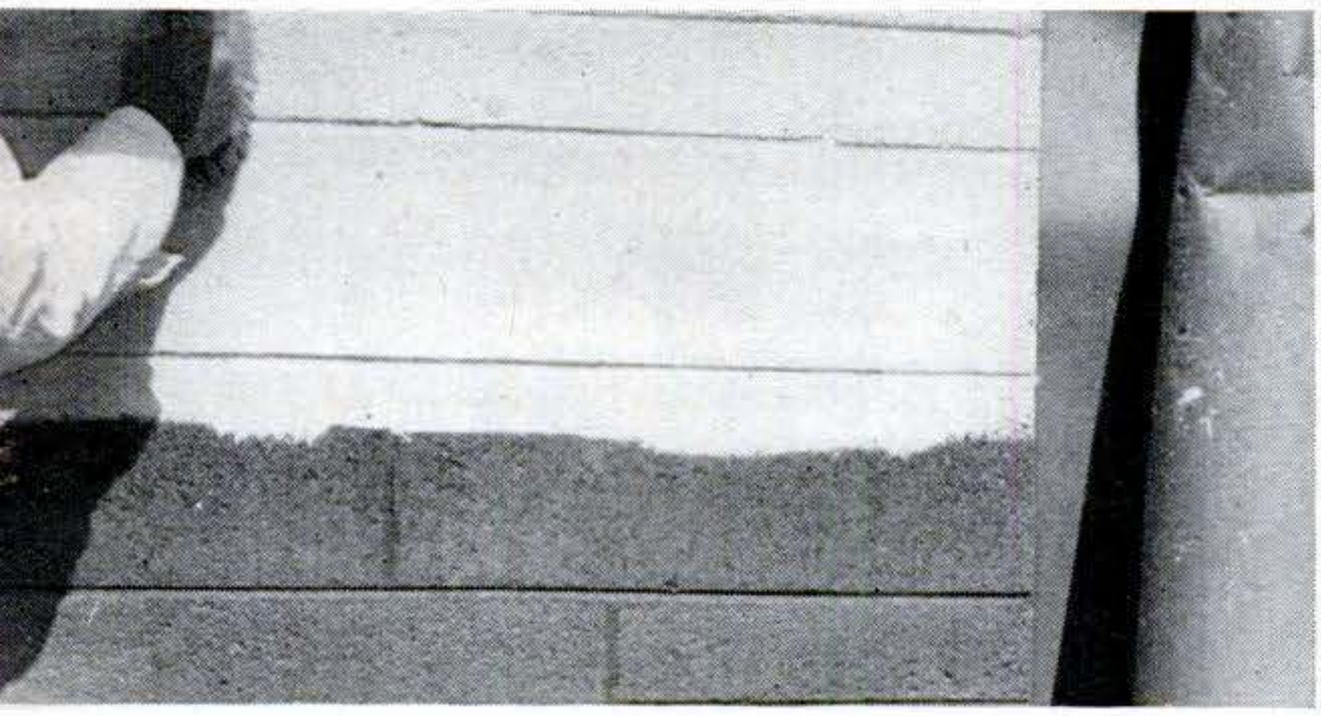


2 MIXING. Stir together until mixture has consistency of thick cream. A hand egg beater is a good mixing tool.

3 SPRAYING. Dampen wall surface; do not soak it. Use garden hose with fog nozzle. Apply paint after surface water disappears.



6 PAINTING. Scrubbing paint into rest of wall finishes first coat. Let it set at least 24 hours before applying finish coat.

7 CURING. Keep first coat damp 24 hours, finish coat damp 48 hours with applications of fine fog spray. Do not soak the paint.

forming tight little plugs that bind mechanically and chemically with the masonry. It costs more than cement-base paints.

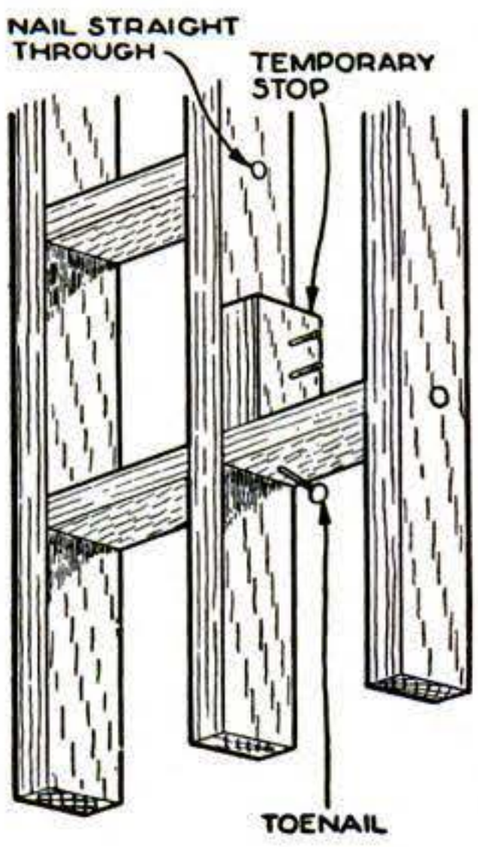
Oil base. This is ready-mixed for exterior or interior use. It dries to a dull, smooth, hard finish like other oil paints. It is designed to keep water from entering a wall, rather than to keep moisture from seeping through from behind the paint. Cost is a bit higher than the others, but the oil-base paints cover more area per gallon.

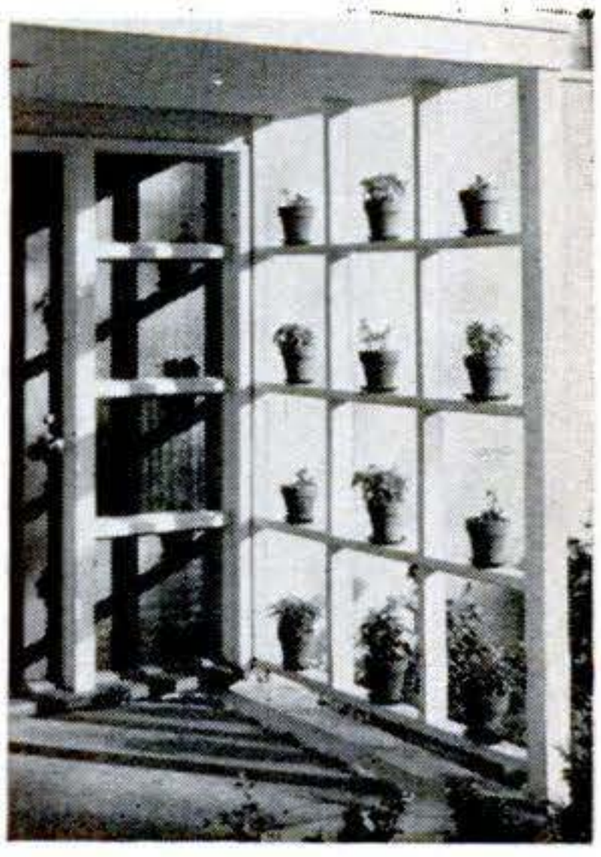
Resin emulsion. Designed for exterior use over any firm, porous masonry surface. It comes in paste form to be water mixed. Cost is about the same as cement-metallic-base paints.

Porch Shelves Give Potted Plants a Place in the Sun

THIS rack at the end of a porch gives potted plants a sunny place to grow and shows them to advantage from all directions.

To make one, assemble a two-by-four or two-by-three frame to fit the porch. Make all openings the same size and slightly higher than they are wide. In this rack they measure 16″ by 20″. Lay the frame on flat ground while you nail it together. You can nail some of the crosspieces straight through the uprights, but will have to toenail others. Tack a temporary stop block as shown to hold a cross member while you toenail it.—*Hi Sibley, Nuevo, Calif.*





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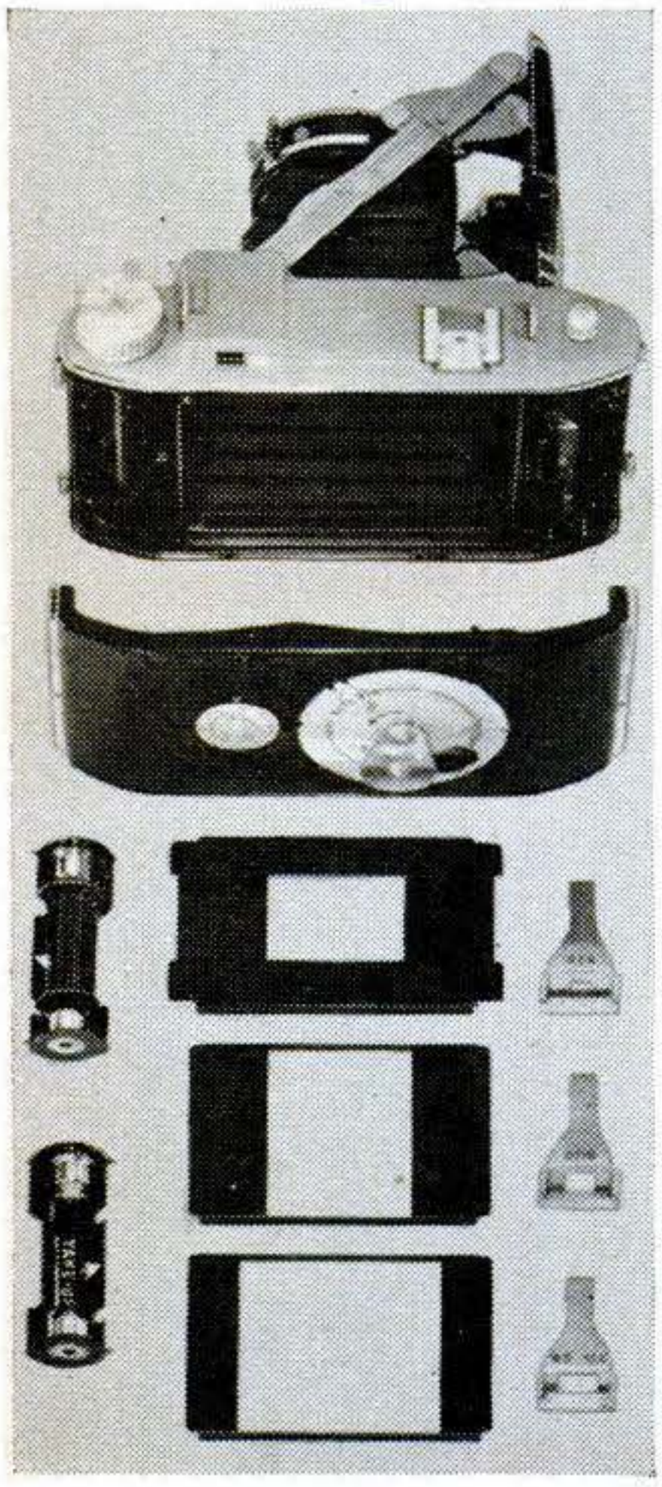
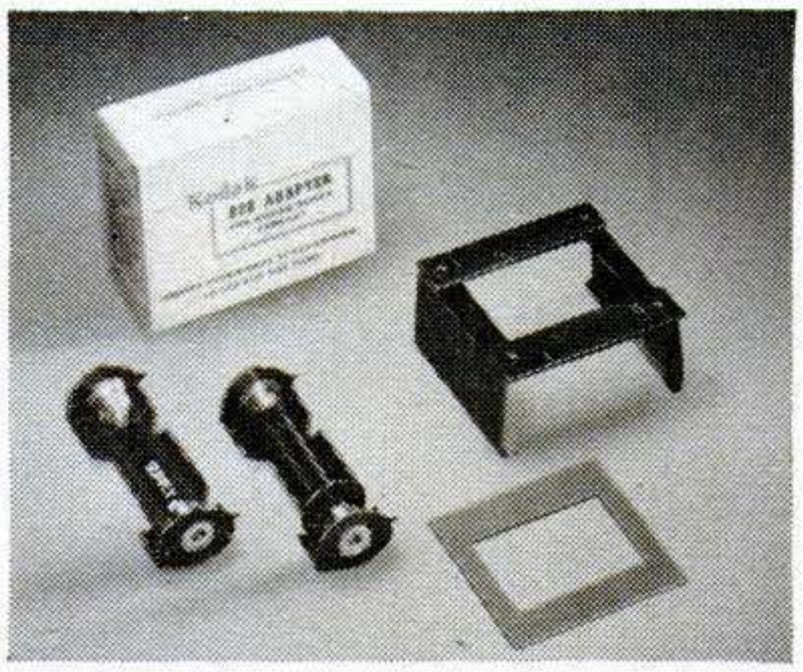
Leather carrying cases—There's no better way to protect your camera than with a sturdy leather Kodak carrying case. Gives it a smart appearance, too. At left is top-grain Kodak Field Case for Kodak Pony 828 Camera, $6.50. Other cases from $3.95 to $10.50 (simulated leather case for Kodak Duaflex Cameras, $2.50). Your Kodak dealer can fit *your* camera with a Kodak carrying case.

Spring Round-up of



Get 4 picture sizes—Kodak Tourist Adapter Kit for de luxe "Tourist" Cameras permits color shots on 828 film, economical half and square pictures on 620 films. $13.25.



Equip your Kodak Reflex Camera for Kodachrome Film—The 828 Adapter for Kodak Reflex Cameras permits you to use economical Bantam-size films—both color and black-and-white. Kit consists of back-frame mask, view-finder mask, and special spool baskets. Price complete: $4.59.

Safe way to clean your lens—Kodak Lens Cleaning Paper and Kodak Lens Cleaner are made to remove dirt and dust from optical surfaces without scratching. Paper comes in booklets of 25 4x6-inch sheets. $.90 for 12 booklets—$.40 for 1-ounce bottle of cleaner.

Keep negatives safe and handy—Kodak Negative Files (left) provide a convenient way to keep negatives in order and easily identified. Transparent, numbered envelopes hold the individual negatives or negative strips. Index pages give quick reference. Sizes from 35mm. to 5 x 7 inches. From $2.37.

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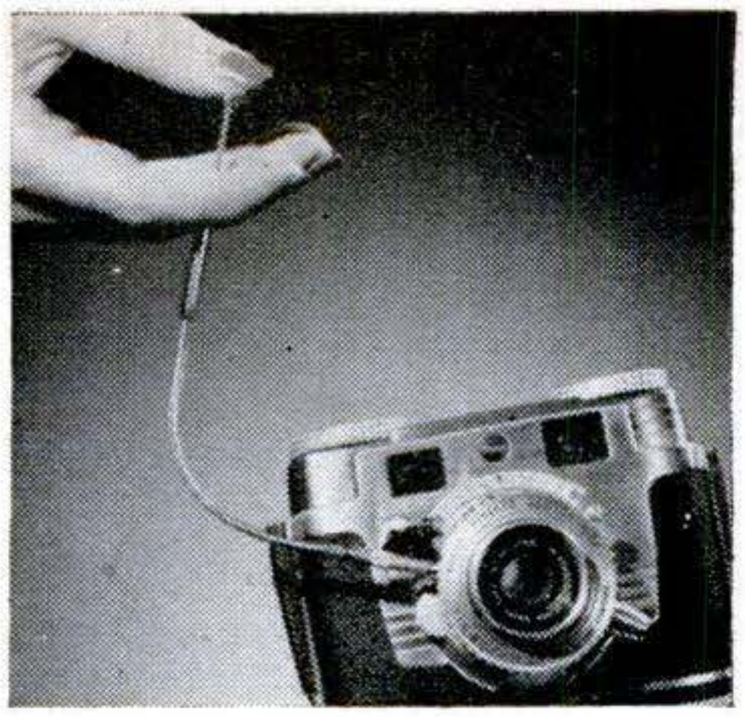
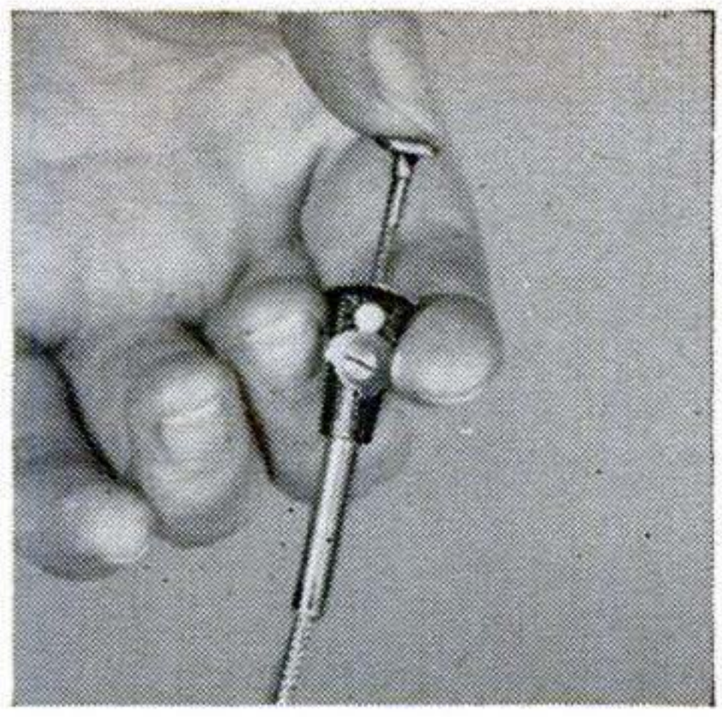
Get in the picture yourself— Attach a Kodak Auto-Release to any camera which has a cable release socket. Set it . . . you have 10 seconds before the shutter clicks. For flash shots, too. $3.86 (does not include cable release).

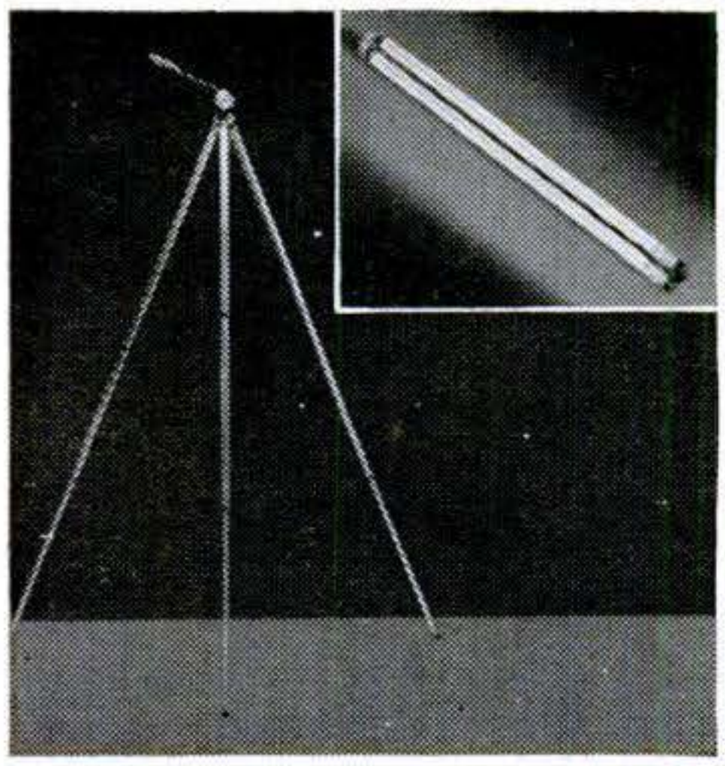


Prevents jarring of camera—The Kodak Metal Cable Release, No. 5, can be used for "T", "B", or instantaneous exposures. The non-stretching braided metal won't kink or twist. 7-inch size is $1.05; 12-inch size, $1.35.

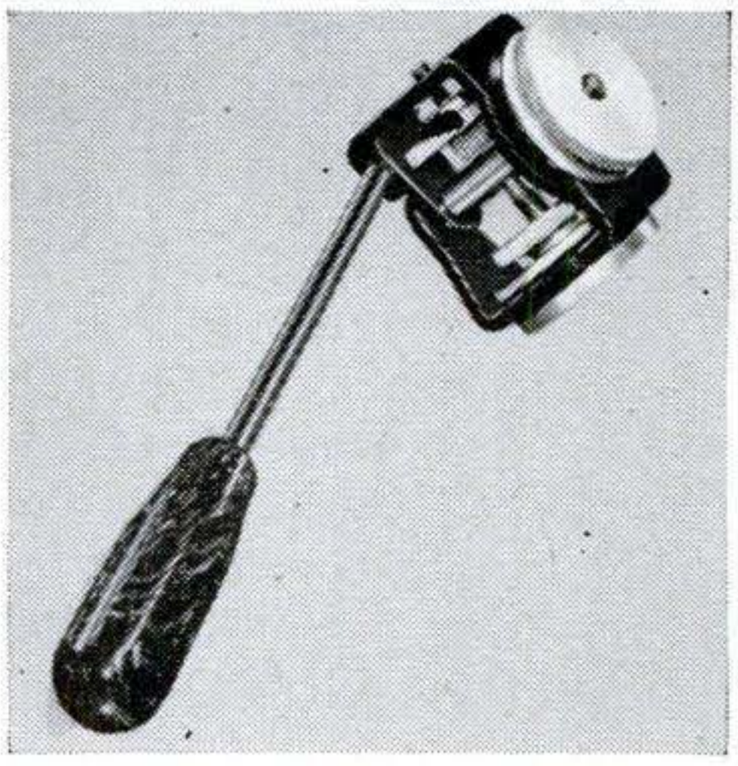


Lets you take time exposures— Kodak T.B.I. Metal Cable Release, No. 2, is made particularly for cameras with "B" but with no "T" setting. The release can be used for "T", "B", or instantaneous exposures. Price: $3.43.

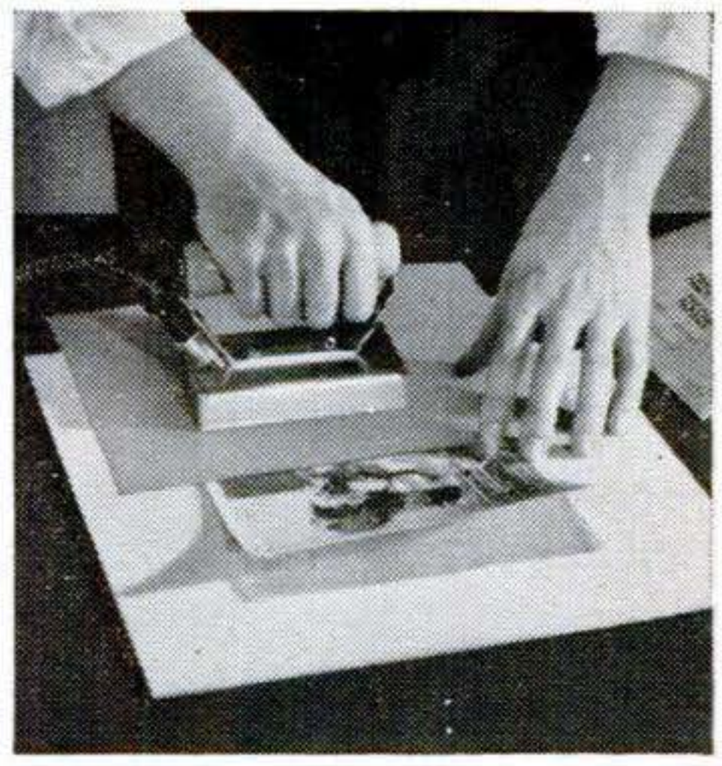
Useful Photo Specialties



Sure way to steady your camera— Kodak Eye-Level Tripod (for still or movie cameras) adjusts for heights from 2 to 5 feet. Folds to 22½ inches. Made of aluminum, it weighs only 2 lbs. $20. (Tripod Head not included.)



For effortless "panning"—The Kodak Turn-Tilt Tripod Head permits you to swing camera while photographing a moving object—without jarring the camera. Multiple-disk, felt-friction clutches insure smooth action. $13.25.



Mount pictures securely—Kodak Thermount Tissue and Kodak Thermount Iron provide a secure method for mounting both black-and-white and color pictures. Iron, $9.85. Tissue (in variety of sizes), from $.20 per package.

You're sure to find all these useful photo specialties (and many other items) at your Kodak dealer's. Make use of his professional knowledge and experience. He'll always be glad to help you choose the right photographic equipment for your needs.

Prices subject to change without notice

EASTMAN KODAK COMPANY, ROCHESTER 4, N. Y.

Kodak
TRADE-MARK

[*Continued from page 155*]

keep a conventional financing plan functioning satisfactorily. The construction loan on each house was advanced in installments—a common practice—as the house reached specified stages of progress.

Delay Upset Financing

When the first houses neared completion, an inspector from the bank came around at the scheduled time for a routine check before okaying the final installment. But the owner had taken on the job of doing the interior painting and hadn't had enough spare time to finish it. So the installment was held up, and, with bills waiting to be paid, the whole financial structure of the project reached a near-crisis.

A meeting was called, and the self-help idea was scuttled. Thereafter, it was decided, members could work as many more than eight hours at *group help* as they wished, and get credit for the extra time as payment toward their own houses.

Obviously, this system would only work in the case of a group project like Hickory Hill. But just as obviously, an individual having a house built and trying to add his own spare-time labor to that of a hired crew would find interruptions of the building schedule even more costly, unless he could hire and lay off mechanics at will. So he would be well advised to limit himself to jobs that would not upset the schedule, even if he *could* do some of the other jobs.

Simple Design Important

The other big *if*, of course, is just common sense: a man should tackle only the jobs that he can do reasonably well. Building materials cost too much to be wasted. The Hickory Hill cooperators did not have to be told this. Nevertheless, they did want to do as much as their abilities permitted. And, since they included men who could hardly drive a nail, as well as one first-rate amateur cabinetmaker, the particular jobs that they have found they can do well are of special interest.

To keep complicated, highly specialized work at a minimum, the architectural member of the group, Danforth Toan, and his professional associates worked out a basic plan for all of the houses. Variations from this basic plan, to fit the different sites and the special needs and tastes of the owners, make each house different, but most of the materials and methods of construction are common to all. The houses are of light, wood-stud construction; exterior walls are mostly cedar, cypress, or fir siding applied over fiberboard sheathing; and interiors are finished mostly in wallboard.

Ditch Digging Is for Pros

The most useful thing that some of the men could do at first was to gather up scrap lumber, clean it up and pull the nails out so that it could be used again. (Prices of lumber being what they are, this was well worth doing.)

They also undertook some of the pick-and-shovel work around the sites, but at this they were frankly not so good. Their sedentary life had not fitted them for it, and it soon became apparent that a laborer accustomed to such work could get about twice as much done in a day as the average white-collar man. So they began trying their hands at semiskilled construction jobs, at which they could at least keep going without so much time out to nurse their breaking backs. Soon, even those who had never considered themselves at all handy with tools were getting their share of the work done quite proficiently.

Professor Is Best Mechanic

All, however, have found plenty that they can do practically as well as a professional—and a lot cheaper. One man spent his vacation helping frame his own house. Another (a professor of botany) is the trouble-shooter and fixer-upper; probably the handiest of all of them with tools—a cabinetmaker by avocation—he goes around rehanging doors and windows that don't work well, putting in overlooked closets, and doing a hundred and one things that call for a Mr. Fixit.

All of which seems to prove that the average man can help himself to a lot of housing, and the man above average can help himself to just that much more. END

Water on Road Often a Mirage

THE "wet spot" that appears on a highway in front of a car on a hot day is only a mirage. It's caused by the bending of light rays from the sky by the heated layer of air near the surface of the road.

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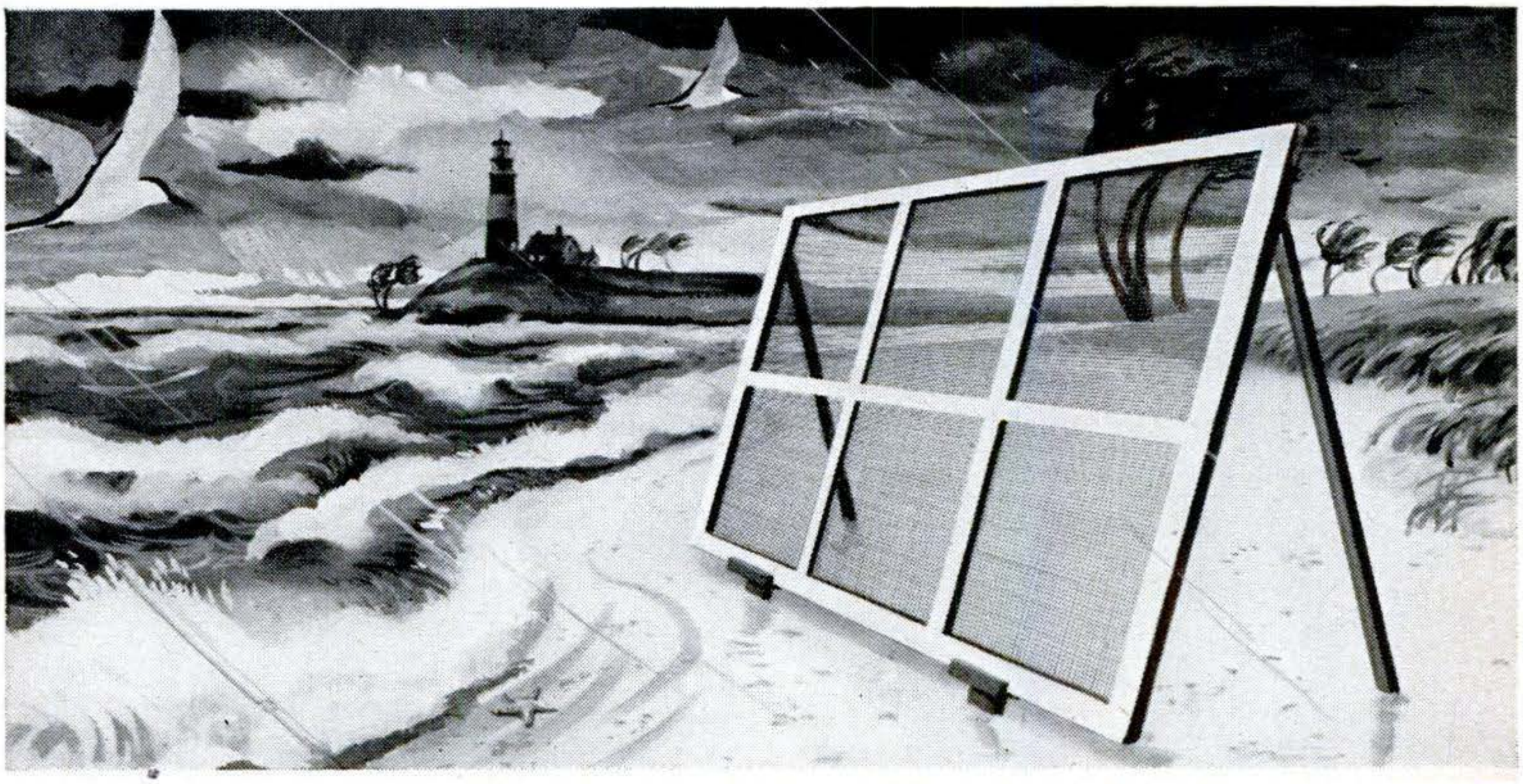
Longest Lasting Screening You Can Buy!

Here's proof that LUMITE* Screening outlasts all other kinds!



Can't be beat for durability! In actual comparison tests under the worst exposure conditions, LUMITE saran screening resisted the effects of weather outdoors *better than ALL other kinds of screening!* LUMITE is unharmed by salt air, humidity, city soot and acid smoke. Further tests proved LUMITE has the strength to take harder blows without bulging or breaking than ALL other kinds of screening!

SAVE WORK, MONEY, THESE 3 WAYS!

1. No painting or varnishing needed to preserve LUMITE because weather outdoors has practically no effect on LUMITE. Ideal for every exterior use.

2. No ugly stains caused by screen rust or other corrosion because LUMITE screening is made, not of metal, but of rustproof, corrosion-proof *saran.*

3. Fewer repairs, fewer replacements over the years, because LUMITE lasts longer and is actually more resistant than ALL other kinds of screening.

RUSTPROOF
CORROSION-PROOF

REPLACEMENT OR A REFUND OF MONEY
Guaranteed by Good Housekeeping
IF NOT AS ADVERTISED THEREIN

Free sample and folder. Write: Dept. PS-24, Lumite Division, Chicopee Mills, Inc., 40 Worth Street, New York 13, N. Y.

LUMITE*
SARAN SCREENING

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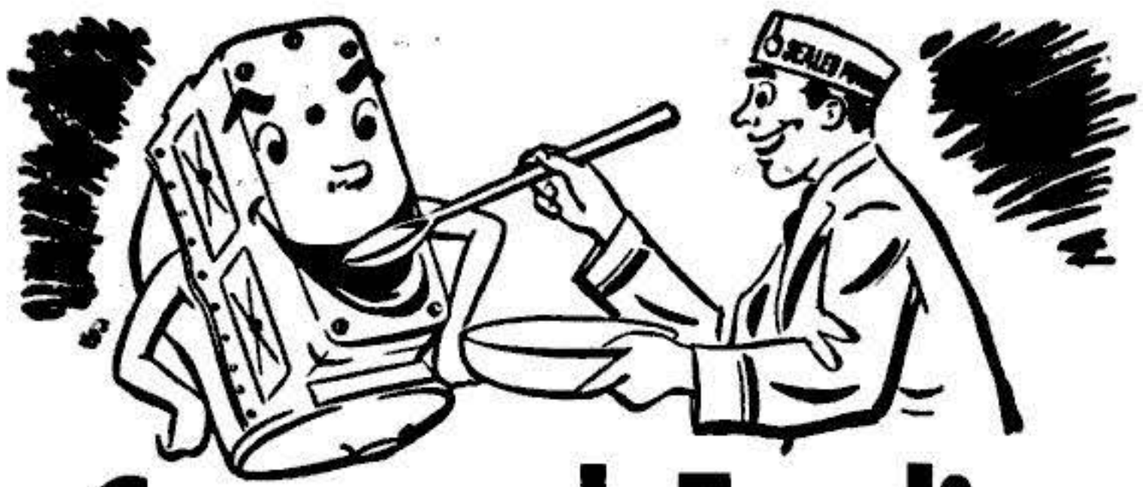


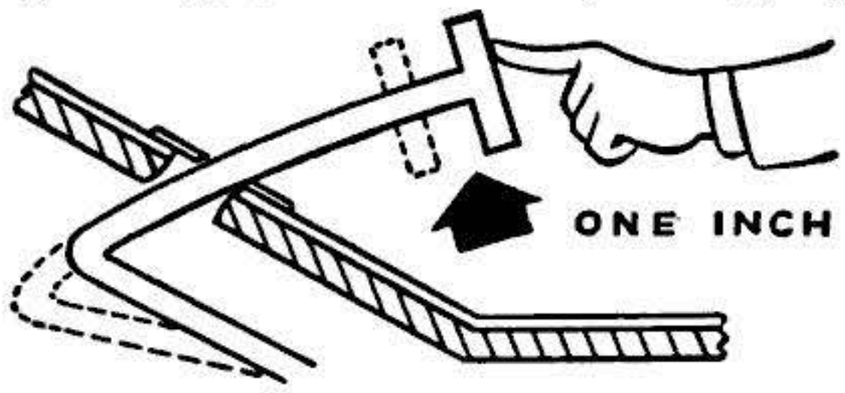
Care and Feeding of Engines

BY S. P. CORP

HOW'S YOUR CLUTCH?

Clutch trouble used to be common. Now clutches have been improved to a point where they are almost trouble-free. Lack of attention and improper driving habits, however, can still cause difficulty.

Check your clutch this spring. It should have an inch of free play in the pedal before it starts to disengage. Press the pedal with your index finger. If there is little or no pedal movement under the pressure of your finger, the clutch may be slipping.



CLUTCH PEDAL FREE PLAY

This can be corrected by adjusting the clutch pedal linkage at the bottom of the pedal. The one inch of free play is to compensate for normal wear.

To avoid excessive clutch wear: (1) Never "ride the clutch." Keep your foot off the pedal except when you are using the clutch. (2) Never slip the clutch to hold your car on a slight grade. (3) Always start your car in low gear, not in second.

SUMMER OIL MUST DO 5 JOBS!

Good oil is cheaper than new parts. Always follow car manufacturer's recommendations as to the viscosity of oil to be used. Remember—it must (1) Reduce friction to prevent wear between moving parts; (2) It must help keep moving parts cool; (3) It must seal piston and rings against loss of compression; (4) It must penetrate into tight places like rings, valve stems and guides; (5) And it must, like a good Navy man, "keep the place clean," picking up foreign particles and depositing them in the oil pan or oil filter.

SPECIAL RINGS FOR LATE-MODEL CARS

New Sealed Power KromeX Ring Sets are the latest answer to the tough punishment of modern engines. They fight heat, friction, corrosion, abrasion! MD-50 Steel Oil Ring controls oil even in badly tapered and out-of-round bores! Write Dept. H-4, Sealed Power Corp., Muskegon, Michigan, for valuable free booklet, "More Power, Less Gas, Less Oil."

I Found My Future in the Past

[*Continued from page 147*]

siliceous substances and clays to which metallic oxides are added for color, is ground to a fine powder and mixed with water. Then the wet enamel is applied to the thoroughly pickled (or cleaned) metal with spray guns, after which the piece is dried in an oven for an hour to remove all traces of moisture.

Next comes firing. This is done at 1,530° for three to six minutes, depending on the type of job. Sometimes three or four coats are required, in which case the same process is repeated for each coat—spraying, drying, firing.

Will Porcelain Walls Be Next?

What about the future? Bob Weaver has plans. Why not use porcelain enamel, he asks, for:

- Hospital walls? These must be kept spotless, and the constant washing wears away nonpermanent finishes, necessitating constant repainting and cutting down the rooms available for use. Porcelain enamel cleans with a rub of a sponge and is easily sterilized.
- Entire interiors of children's rooms and nurseries? With porcelain-enamel walls, kids could scribble to their heart's content. A duster or damp sponge could remove the results at once.
- Basements? Says Weaver: "When the architect specifies poured-concrete foundations, he could take any standard porcelain-enamel panel and put it in the forms before the cement is poured. When the cement hardens and the forms are taken away, you have a room completely enameled in color, all ready to use as a game room."

Bob Weaver dipped into the past and found his future. His example is a shining one for those who feel success lies only in the new discoveries. END

All Babies Have Blue Eyes

ALL newborn infants have blue eyes. The pigment cells of the iris that determine eye color do not develop until six months to a year after birth.

Flints Aren't Really Flint

THE so-called flints for cigarette lighters aren't flint at all. They're usually an alloy of cerium, iron, chromium and smaller amounts of bismuth, copper and silicon.

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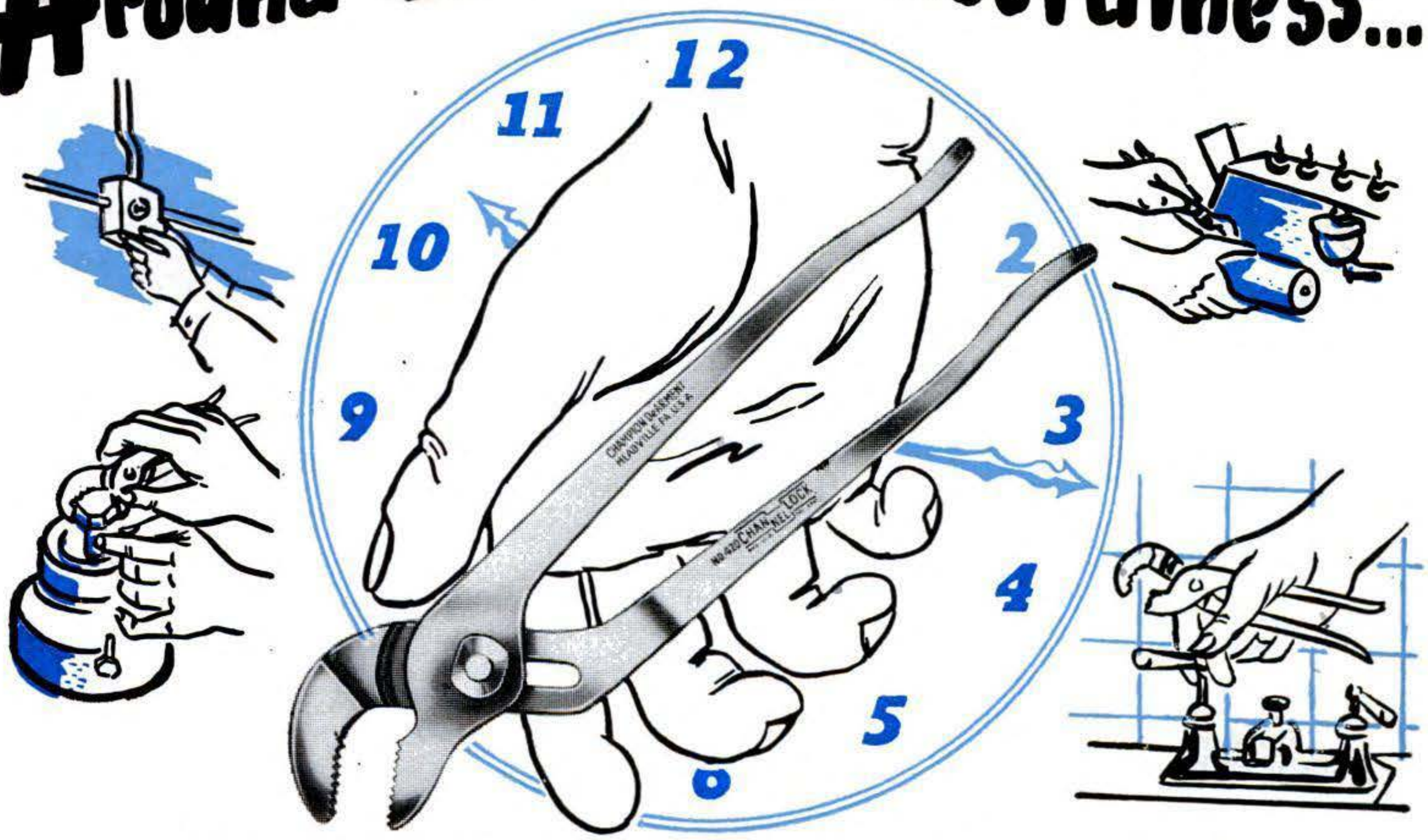
Around the clock usefulness...



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Made only by CHAMPION DEARMENT!

No matter what the job—plumbing, electrical, automotive or whatever, Channellock pliers are handy to have around. The patented Channellock principle permits a wide range of size adjustments without decreasing gripping power or leverage.

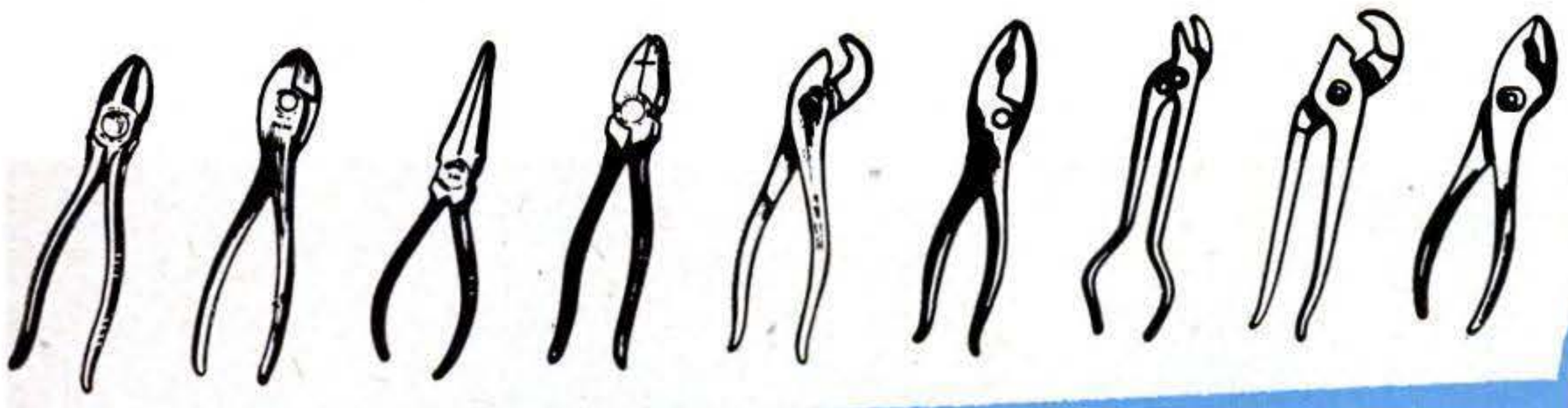
Channellock pliers are made by Champion DeArment—for nearly 3/4 of a century manufacturers of highest quality tools.

Dad, Mom, or the kids will find plenty of uses for Channellock pliers.

And remember—Only Champion DeArment makes Channellock.

Send for Catalog D14 today.

CHAMPION DEARMENT TOOL CO. • Meadville, Pa.



Channellock pliers are listed in the Yellow Pages of most Telephone Directories under "Tools"

Only CHAMPION DEARMENT...

makes CHAN NEL LOCK

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ON EVERY COUNT a shop is money ahead with Snap-on Pullers! *Money ahead* in first cost... because fewer Snap-on units cover a far wider range of pulling operations. *Money ahead* in time saved per job... right down the line Snap-on gives you the fastest, most efficient and adaptable pullers yet designed. *Money ahead* in durability... because they're *Snap-ons,* finely manufactured to traditional Snap-on standards of rugged strength and long life. Write for free catalog—covers the complete line of Snap-on Pullers and 4,000 hand and bench tools... *America's finest!* Never sold in stores... buy from Snap-on branches or direct from factory.

SNAP-ON TOOLS CORPORATION
8060-D 28th Avenue
Kenosha, Wisconsin
*Snap-on is the trademark of Snap-on Tools Corporation.

Gus Bets on a Long Shot

[*Continued from page 196*]

Gus thought for a moment. "Well," he said finally, "I haven't got that much ready cash on hand. Can you wait until I go to the bank and draw it?"

Kell looked at his watch again. "Ten past 11," he said. "Well, sure. You ought to be able to get back here in time for me to call the other folks before noon and tell them the deal's off."

"I'll get back as fast as I can." Gus pulled his coat on over his coveralls. "Stan, make Mr. Kell comfortable until I get back."

Gus Closes the Deal Fast

Gus got back to the garage at about a quarter to 12. "Here's your money, Mr. Kell," Gus said, as he handed over five crisp 100-dollar bills. "And thanks for a nice deal." Five minutes later the transaction was completed. Kell had his five hundred, Gus had Kell's option papers duly signed over and Stan wore a big grin.

"Mind if I use the phone?" asked Kell.

"Help yourself. I'll get back to the shop and get your car ready for you."

Gus was just about to slam down the hood on the car when Kell appeared. "Well, that's that," he said, rubbing his hands together. "And much obliged to you, Mr. Wilson. When you get that new garage built I'll have to come out and see it."

As Kell backed his car out, Gus turned to Stan. "Hope I've done the right thing."

"You've got the option, haven't you? Now those other lugs can't move in on us. I can see it now—a brand-new Model Garage down on the corner."

Gus chuckled. "We'll see."

Gus's Long Shot Romps Home

About 10 minutes later Stan heard Gus answer the phone. He didn't talk long and shortly walked into the repair shop with a mile-wide grin on his face.

"Stan, it worked."

"What worked?"

"They nabbed all three of them."

"All three of who?"

"Why, our old friend Mr. Kell and the two talkative fellows who had dinner last night at Dan's place. Sergeant Jerry Corcoran of the State Police just picked them up down at Terry's Grill. They were busy dividing up the loot."

"Whoa, slow down, boss," put in Stan.

[*Continued on page 252*]

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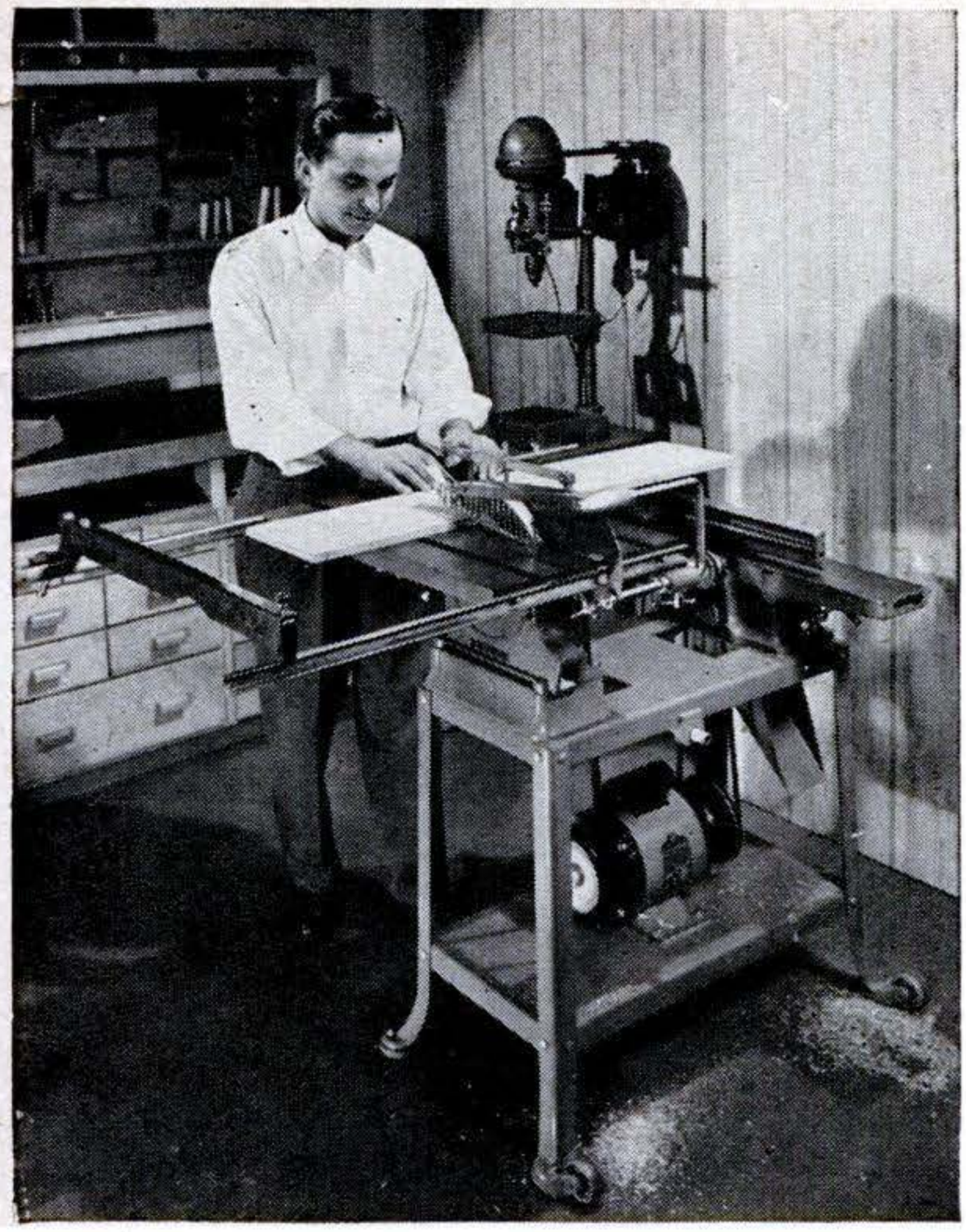

You can do almost every woodworking job you'll ever need in this DELTA WORKSHOP

. . . AND IT COSTS LESS TO OWN THAN YOU THINK!

These two Delta Power Tool units are the answer to your need for a complete yet flexible home workshop. For example, look at the tremendous versatility they offer:

- The Saw-Jointer combination performs all basic cuts—rips, miters, cross-cuts . . . makes compound miters, cut-offs . . . joints, planes . . . with accessories it makes dado grooves, shapes, tenons, rabbets, etc.
- With the drill press, you can drill, mortise, rout, carve, sand, shape, polish and grind—and with the exclusive Delta interchangeable spindle, it takes only seconds to put on the new cutting tool.

These power tools are ready to use *when* you want to perform any given operation. Behind them, too, stands the Delta guarantee of quality and precision famous throughout industry.

SAW-JOINTER AND DRILL PRESS

This basic shop will do practically every operation required when you build projects or do home repairs. It is available in sizes to fit your needs and budget.

- **HOMECRAFT UNIT** (4" jointer, 8" saw, 11" drill press) **$147.60**
- **HOMECRAFT UNIT** (4" jointer, 8" saw, 11" drill press) **$205.90**
- **INDUSTRIAL UNIT** (6" jointer, 10" saw, 14" drill press) **$357.40**

Motors and accessories extra.

Talk to your Delta Dealer and compare before you buy—and if you'd like to own this shop, send for free bench plans and a special booklet showing you how to plan your own home workshop. Use the coupon!

DELTA POWER TOOLS Another Rockwell Product

53 Machines • 246 Models • More Than 1300 Accessories

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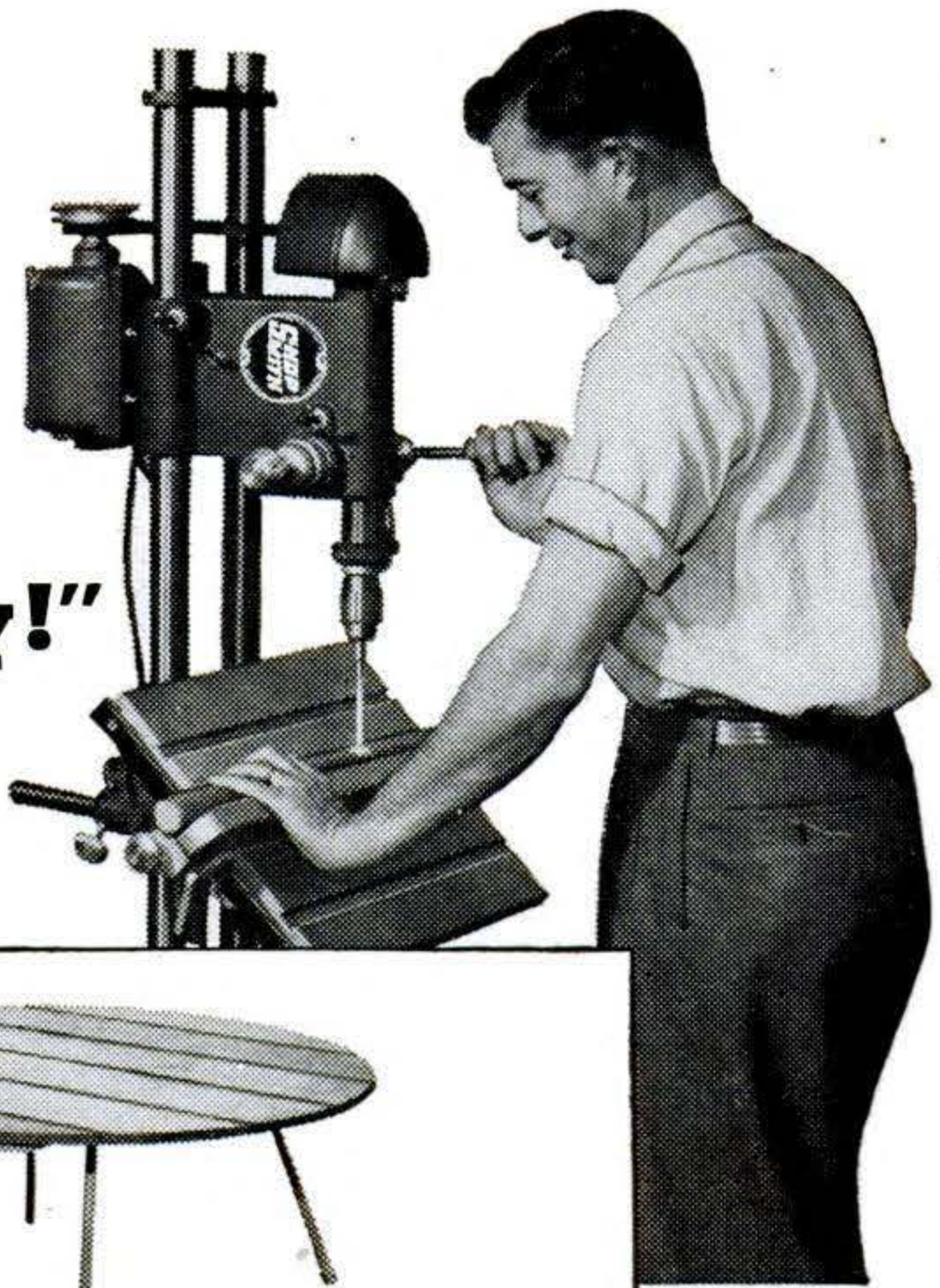
"SHOPSMITH makes the toughest jobs easy!"



"I'll match SHOPSMITH against any power tool for regular performance. In accuracy, capacity and quality of construction, it ranks with the best of them. And when it comes to difficult or unusual operations, like cutting out a circular table top or drilling into the ends of boards, SHOPSMITH has no equal!

"Take the garden furniture I just made, for example. The frame for the chair is doweled and glued. You can see that tricky angles were involved. With any other drill press, drilling holes for the dowels would have required complicated jigs. But not with SHOPSMITH. I just set up SHOPSMITH as a horizontal drill, laid the work flat on the table and fed the drill in from the side. Saved myself a couple of hours on that one operation alone.

"All the way through, SHOPSMITH's flexibility made the tough jobs easy. There's hardly a sawing, sanding, drilling or woodturning job that can't be done faster and better with SHOPSMITH!"

SHOPSMITH is a *complete* power workshop . . .

- 8" circular saw • 12" disc sander
- 33" wood lathe • 15" drill press
- Horizontal drill

SHOPSMITH complete except for motor* $189.50

*Special ½-hp., capacitor-type, 120-volt, 60-cycle motor. . . . **$34.50**

SHOP SMITH®

SEE SHOPSMITH DEMONSTRATED AT LEADING HARDWARE AND DEPARTMENT STORES OR ANY MONTGOMERY WARD STORE. WRITE FOR FREE SHOPSMITH CATALOG

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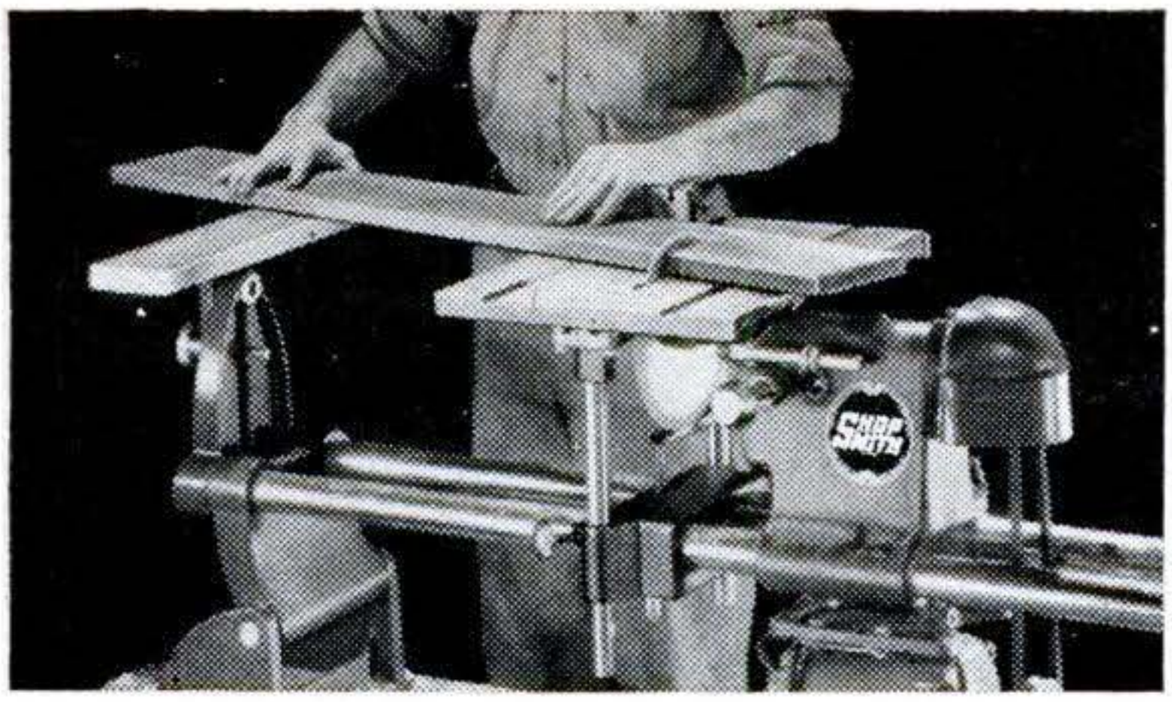
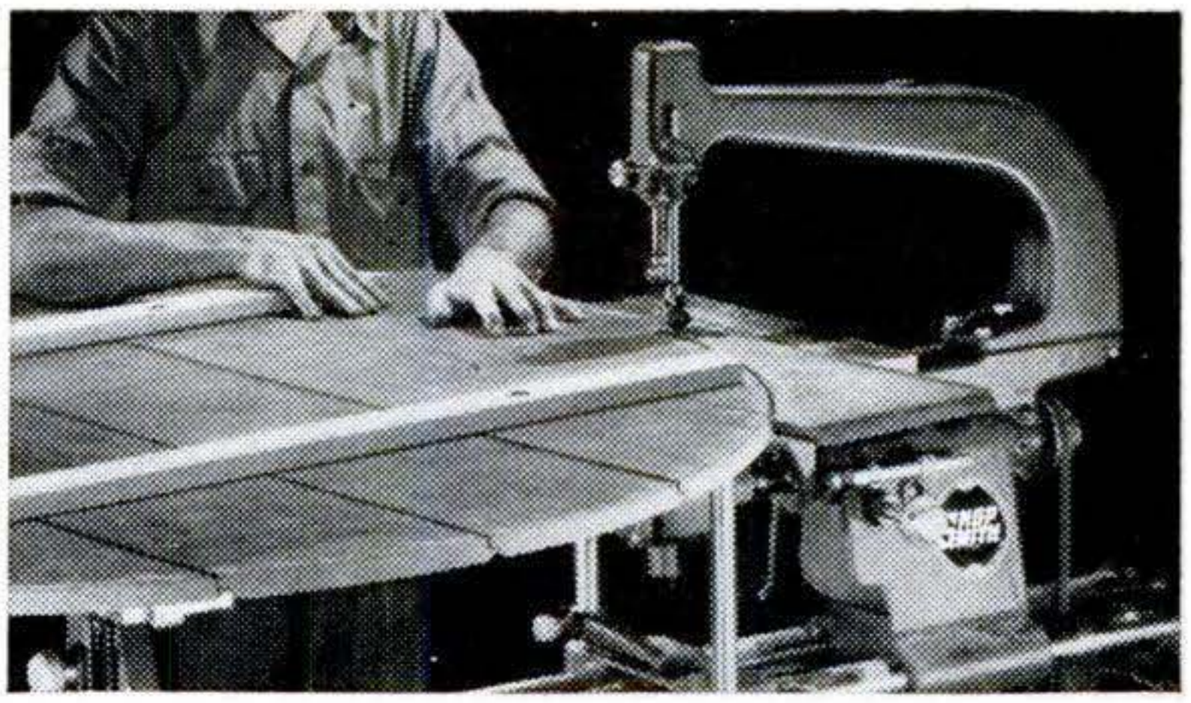
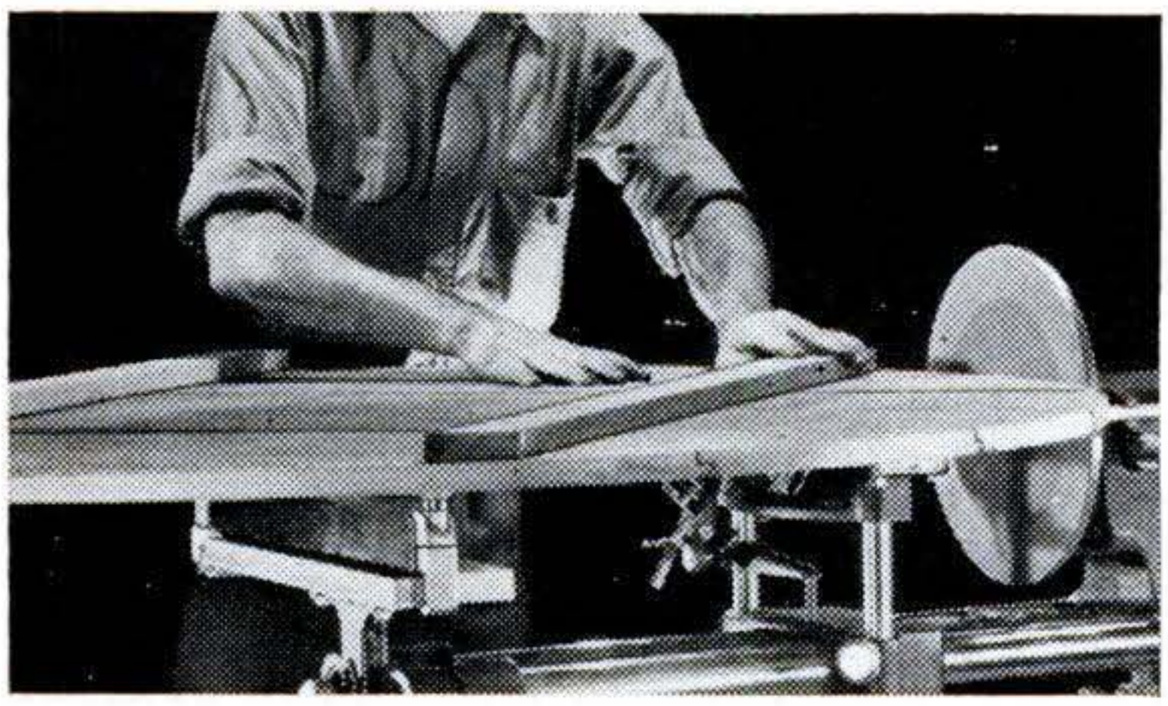


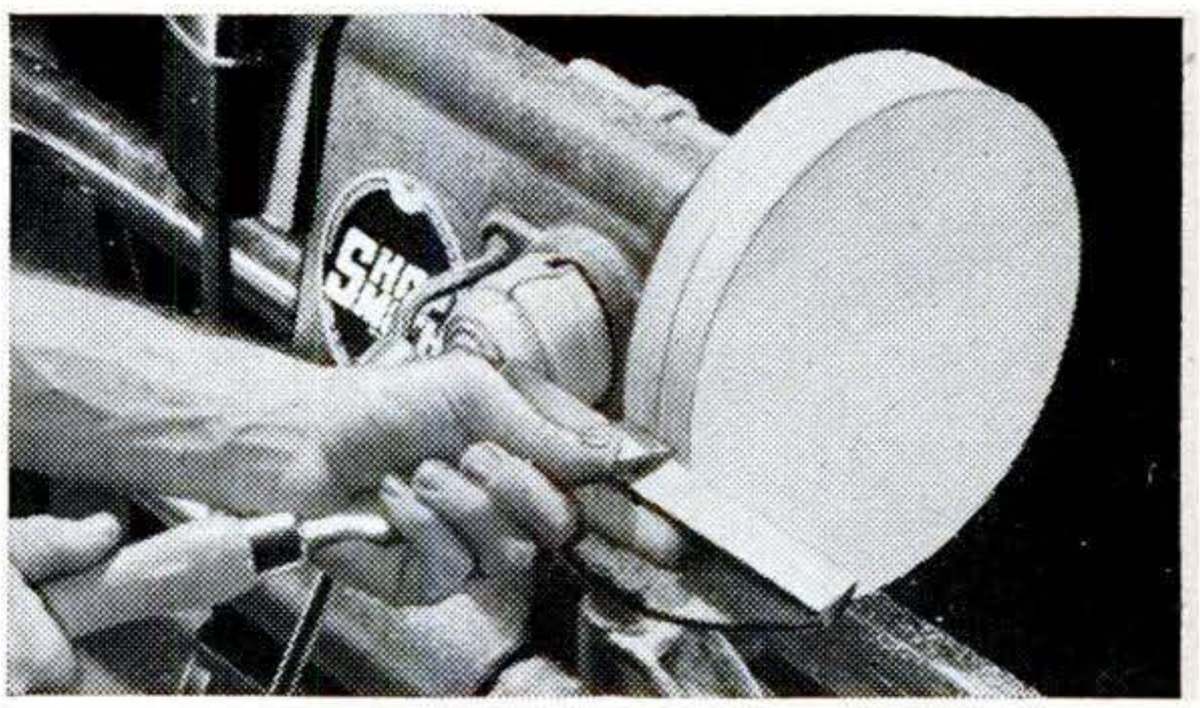
1 "**BIG TABLE.** SHOPSMITH's table extension and extremely accurate miter gauge make it easy to cut long boards to precise lengths and angles. Table area (with extension) exceeds that of many expensive production-type table saws."



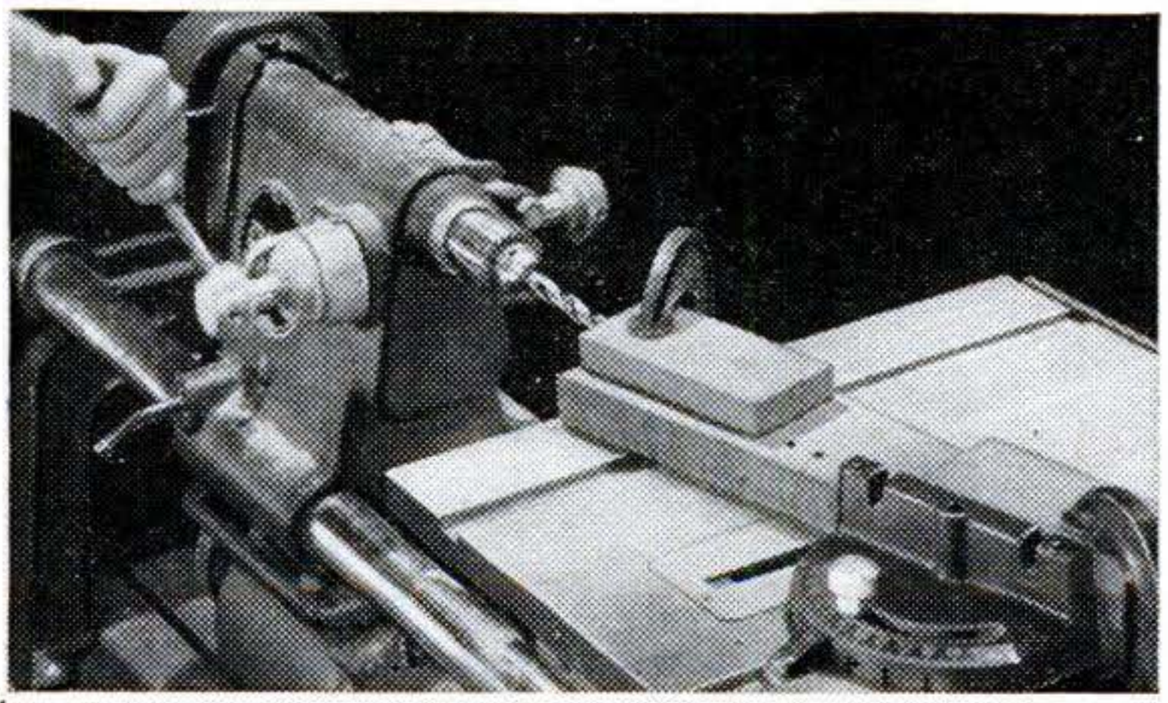
2 "**ROUND TABLE TOP** was cut with SHOPSMITH jig saw ($34.95). It was a simple operation. I used the SHOPSMITH lathe center as a pivot and supported it with the table extension and rip fence. With this ready-made jig, the job was a cinch!"



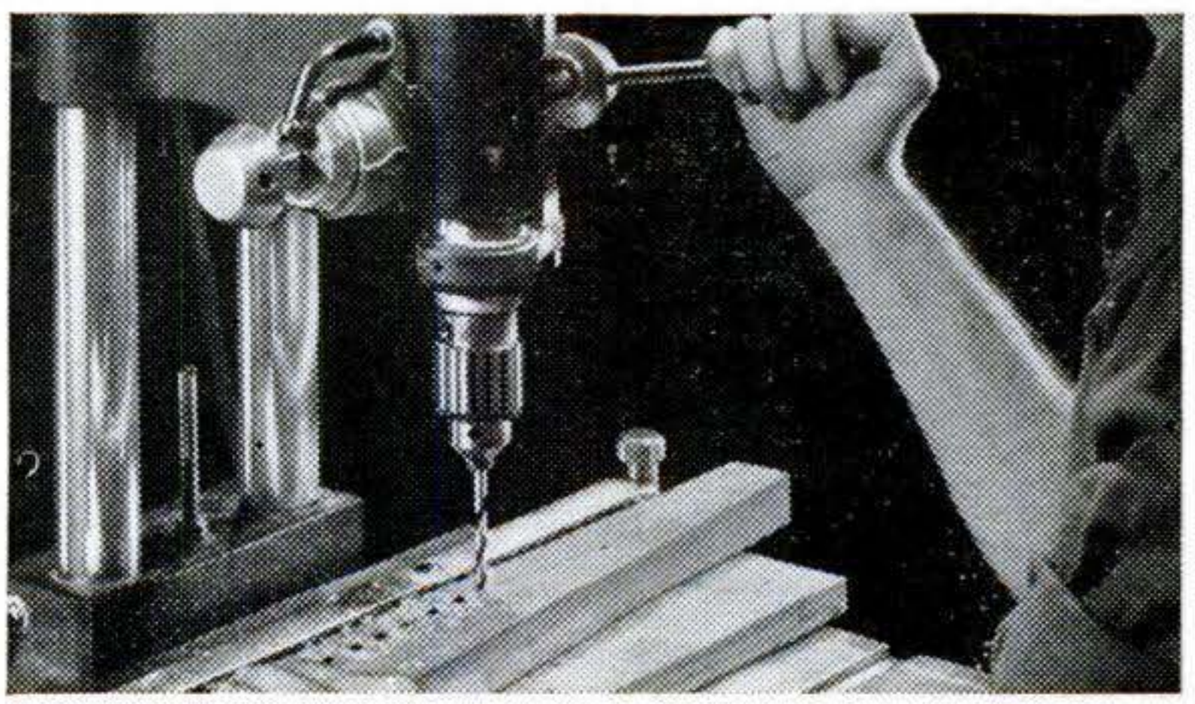
3 "**SMOOTH SANDING.** It was just as easy to sand the edge of the round table top. Using the same pivot setup, I simply substituted the sanding disc for the jig saw. By rotating top slowly, I got a perfect circle and a beautifully smooth, right-angled edge."



4 "**DUPLICATE TURNING.** The wheels for the chair were turned together on SHOPSMITH in the lathe position. The things I like about the lathe are its big capacity (15" swing, 33" between centers), its time-saving sliding tool rest and its rugged precision."



5 "**END DRILLING.** The framing members for the chair were end drilled for dowels the easy way—with SHOPSMITH set up as a horizontal drill. This exclusive SHOPSMITH feature is a real time-saver. More important, every joint fits perfectly!"



6 "**ROWS OF HOLES.** Here's another case where SHOPSMITH not only saved me time but did a better job. To drill lacing holes in the chair frame, I used SHOPSMITH as a vertical drill and used the rip fence for a guide — an easy, natural way to align holes."

MAGNA ENGINEERING CORPORATION
Dept. 197-A
at factory nearest you:
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Please send me free 16-page SHOPSMITH catalog. Dept. 197-A

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THIS HANDY Black & Decker ¼" Electric Drill is so versatile it drives many accessories to handle job after job. So speedy and easy-to-handle it helps you do more work in your spare time. So well-built it gives you trouble-free performance year after year. So down to earth in price you can't afford to be without it. No wonder well over a million have been sold!

Try a B&D ¼" Drill and accessories today at your hardware, appliance or department store. It's its own best salesman! THE BLACK & DECKER MFG. Co., Dept. H4S, Towson 4, Maryland.

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ELECTRIC UTILITY TOOLS

PORTABLE ELECTRIC TOOLS

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Gus Bets on a Long Shot

[Continued from page 248]

"You lost me going around that last turn."

"Well, first of all, when I finally found what was causing Kell's engine to miss I realized it was no accident. Someone had deliberately cut the insulation on the wire so that it would short-circuit on the metal ignition-wire conduit."

"You mean he wanted something to be wrong with his car so he'd have an excuse to come here and talk to you?"

"Right. Then when I suspected that, his whole story began to sound awfully pat. Finally, when I went down to the bank I asked them about the property. It turned out they're handling it and no one's ever held an option on it."

"But what about your five hundred bucks?"

Gus Thinks of Everything

"Right now, it's safe in Jerry Corcoran's pocket." Gus chuckled. "They're marked bills and the bank has a record of the serial numbers."

"But gosh, what a gamble you took," Stan protested. "That guy might have scrammed with your money before he was caught."

"It wasn't really much of a gamble. I called Jerry from the bank and by the time I got back he was parked up the road here ready to tail Kell the minute he left.

"And just to make sure," Gus added with a wink, "I stuffed a wad of waste soaked in gasket cement into the end of the exhaust pipe on Kell's car. He couldn't have got very far before that cement would have hardened and the back pressure would have killed his engine."

Swindlers' Scheme Backfires

Gus fired up his pipe and blew a couple of smoke rings. "According to Jerry, this bunch of swindlers has been pulling the same game in four states. Haven't varied it a bit—the same pitch within earshot of someone they knew was a good friend of the intended victim and would tell him."

"Gosh, and here all morning I've been dreaming about a new Model Garage," sighed Stan.

"This place *is* kind of small, isn't it?" Gus mimicked the dapper Mr. Kell.

"Yeah," said Stan, laughing. "And, boy, *what a reputation*. I'll bet Kell will remember it for a long, long time." END

Next Month: Gus tackles a flat-tire mystery.

PATENTED
CORALOX
INSULATOR

Chevrolet's Choice

ALSO CHOSEN FOR NEARLY AS MANY NEW CARS AS ALL OTHER MAKES OF SPARK PLUGS COMBINED

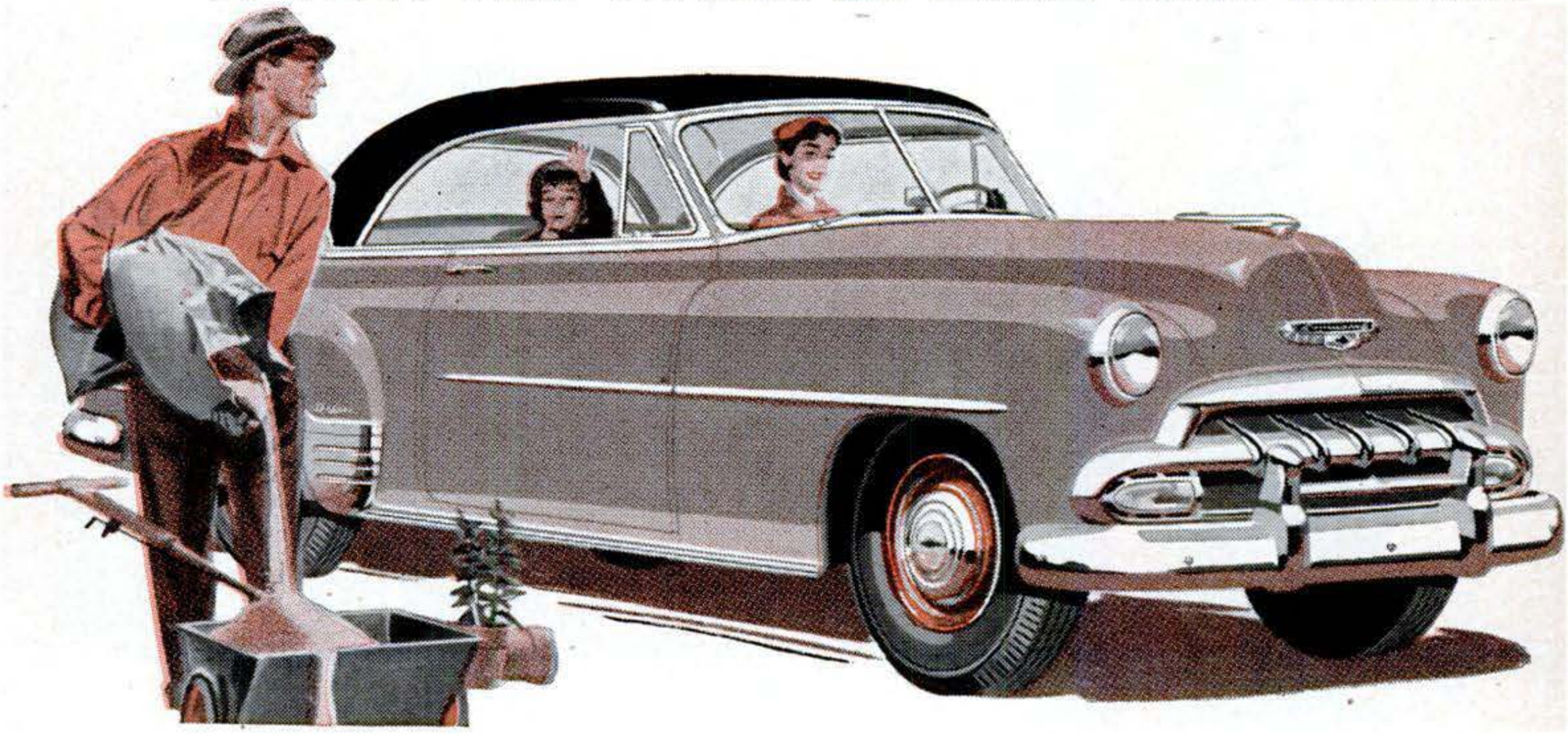
AC's patented *CORALOX* Insulator is the greatest spark plug advancement in 40 years. It contributes definite performance advantages that owners of any make of car can recognize and enjoy.

Easier starting. Better idling. No misfiring and loss of power at high speed or under heavy load.

CORALOX accomplishes these benefits because it is far superior to any previous insulator. High temperatures don't crack it nor cause it to lose its insulating properties. It heats up quicker in a cold engine, burning away oil and wet carbon deposits. It doesn't attract oxide coating.

Chevrolet and other leading manufacturers have specified ACs as standard equipment because of these *CORALOX* superiorities. You can have them, too. Just have your service man install a set.

AC SPARK PLUG DIVISION GM GENERAL MOTORS GENERAL MOTORS CORPORATION



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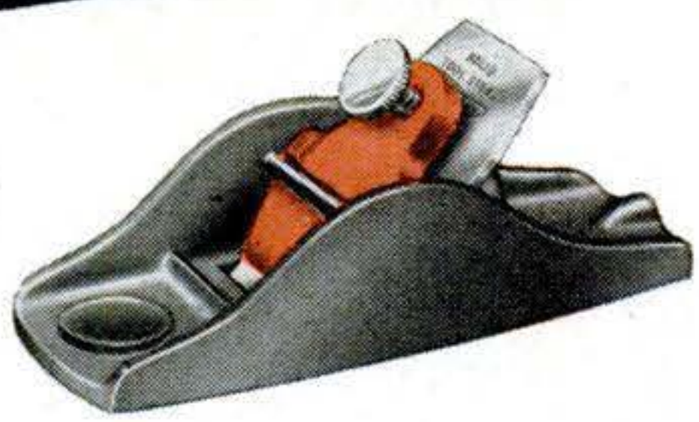
for Hardware Week, April 17-26

3½" Long
1" Solid Tool Steel Cutter



Every home owner, farmer, hobbyist, modelmaker and professional craftsman will find hundreds of time-saving uses for this sturdy, well-built little Model and Patternmakers Plane.

It's part of the world's finest line of bench and block planes — with solid tool steel cutter skillfully hardened and tempered to take and hold a razor-keen edge. It comes to you honed and ready to use.

Ideal for close quarters — it cuts clean and fast, with or across the grain. You'll find it perfect for planing sticky doors and windows, for edging boards, shaping curved surfaces and many other jobs. Cuts soft and hard woods.

Look for it in the bright red and black display carton at your hardware dealer's. Get one and save money while this little plane of endless uses is being offered at a special low price during Hardware Week, April 17-26.

Millers Falls Company · Greenfield, Mass.

MILLERS FALLS TOOLS
SINCE 1868 ®

The Mark of Superiority

New Method Makes Lifesaving Easier

[Continued from page 140]

Dr. Gordon set up equipment in the Cook County Hospital, moved a cot into an office across the street, and arranged to be called whenever, day or night, a patient was about to die. As a result he and his associates were able to apply all the principal manual-respiration methods—including Silvester, Schafer and Nielsen—while the bodies were still warm.

In each case a tube was inserted into the windpipe and an inflatable cuff around the lower end was blown up to get a tight fit and thus make certain that air could enter and leave the lungs only through the tube. The outside end of the tube was then connected with a spirometer. This is a device —familiar to anyone who has taken a basal-metabolism test—in which a bellows-like apparatus measures the amount of gas pushed out and pulled in.

Double-Action Method Is Best

The investigators answered 200 calls, found 109 suitable subjects, and in most cases completed their tests within 60 minutes after death. Their findings: double-action methods of artificial respiration provide twice as much ventilation as single-action.

Then the Gordon-Ivy group decided to go all the way. The scientists gave 11 healthy medical-student volunteers, ranging in age from 22 to 31, large injections of curare and barbiturates—the curare to paralyze the muscles, the barbiturates to keep the men from worrying.

As soon as a man had completely stopped breathing, the doctors fitted him with an endotracheal tube—as they had the corpses —and began resuscitation, using first one method and then another.

Effectiveness Confirmed

The results were essentially the same as before. Into a person who had stopped breathing but was still alive, the operators could get twice as much air as into a corpse, but the relative values of the methods remained unchanged: push-and-pull was twice as good as push.

Before these studies had been quite completed, the Armed Forces entered the picture. They wanted to know what was the one best method—applicable anywhere by anybody—to get a man breathing again.

[Continued on page 258]

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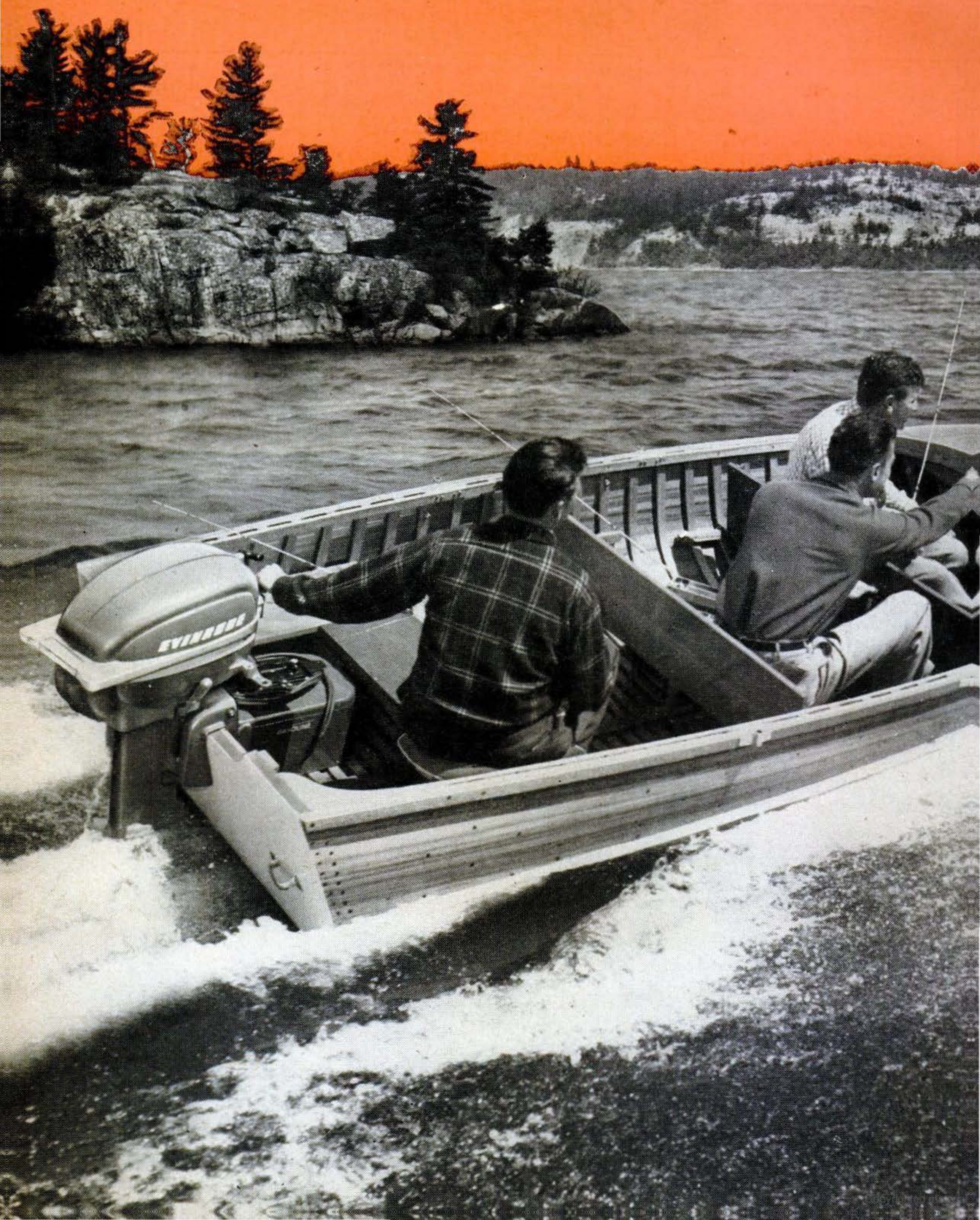
one run—and



you know!

It's easy to settle on the outboard you want... it's easy ... it's fast... and it's *Fun!* Take a look at the Evinrude that's hustling this "fisherman's express"... *take a run with Big Twin!* Try it!... and you'll never settle for less!

Take over the controls and see for yourself! Start in Neutral and back away... Big Twin's gearshift makes dockside maneuvering simple as handling your car! Shift to Forward—flick the Roto-Matic Control—Big Twin's blazing power smacks your boat to top speed in breathless seconds! You're streaking along at a 30-mile clip—smooth, quiet and steady! Far-off fishing spots are only minutes away... with Big Twin, the run is the biggest part of the fun!

Like trolling? Close your throttle 'way down... you whisper along with bare steerage way... for Big Twin is the 30-miler that trolls like a small motor. On every count... for those who want the last word in fine outboard performance... Big Twin is the motor. *One run—and you know!*

SEE YOUR EVINRUDE DEALER—and get the good news on price... the 25 horsepower* Big Twin is yours at lowest price per horsepower of any outboard motor. If you'd like Big Twin's kind of performance for smaller boats, it's yours in two companion models—the 14 H.P. Fastwin and the Fleetwin, 7.5 H.P.

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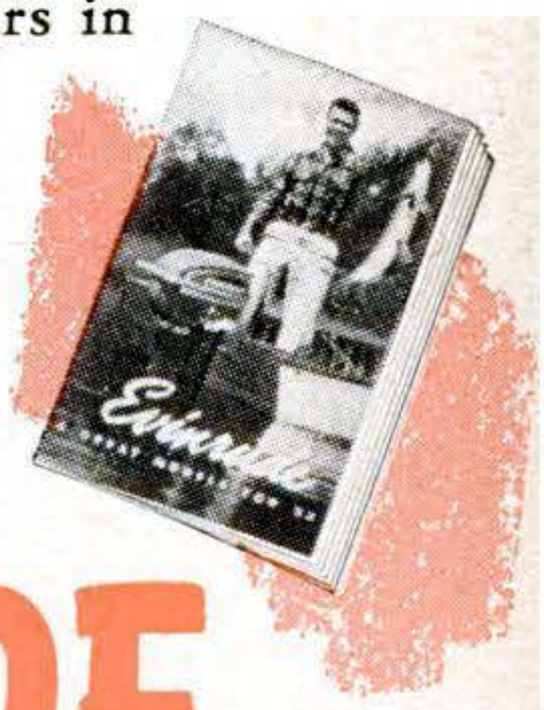

EVINRUDE MOTORS
4787 N. 27th STREET, MILWAUKEE 16, WIS.
In Canada: Manufactured by Evinrude Motors, Peterborough, Ont.
*Power ratings are O.B.C. certified brake H.P. at 4000 R.P.M.

EVINRUDE

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RUGGED WORK IN ALASKA! This boat is one of a fleet of more than a thousand gill netters fishing the stormy waters of Bristol Bay, Alaska. Formerly restricted to the use of sail only, the fleet is now being rapidly converted to power. The Evinrude 25 H.P. Big Twin mounted in the stern provides reliable power in toughest going—saves space—save weight—saves cost—and drives this heavily constructed 29-footer at approximately the same speed as a 40 H.P. inboard engine.

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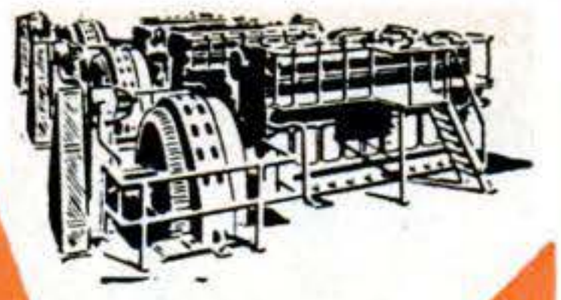

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Great basic invention—the dynamo. Its power turns our wheels, operates our factories, provides the speed required to run our modern world.

The Plumb Hammer is the pace-maker on any job. Scientific design and perfect balance make it much faster, easier to use.

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New Method Makes Lifesaving Easier

[Continued from page 254]

The authorities whom they consulted agreed that research so far had been on too small a scale to point unhesitatingly to the one technique that ought to be endorsed. So a research program big enough to answer the question quickly and once and for all was launched. To direct it, Dr. David B. Dill, an outstanding physiologist who is scientific director of the Army Chemical Center and a former president of the American Physiological Society, was chosen.

Research Is Stepped Up

In Philadelphia, under this program, Dr. Comroe tested manual methods on 13 hospital patients whose breathing had stopped, in some cases while they were under anesthesia. In Boston, Dr. James L. Whittenberger of the Harvard School of Public Health worked with eight other such patients.

In Springfield, Mass., Dr. Peter V. Karpovich of Springfield College used as guinea pigs healthy and fully conscious men and women. And in Chicago the Gordon-Ivy team again worked with curarized medical students—50 this time.

More Air, Better Breathing

All four investigations confirmed the previous findings. For example, the Chicago group found that with the Schafer method only 485 cubic centimeters of air were exchanged with each application of pressure. That's about one pint. With the double-action methods, such as Nielsen's, it was about one quart.

The Chicago researchers found some highly significant additional evidence. If the heart fails, manual respiration won't do any good, and sometimes heart failure can't be avoided. It is less likely to happen, though, when there is sufficient oxygen in the blood.

Dr. Gordon took a series of blood samples from some of his volunteers as they lay in the hospital, unable to get a breath of air except that supplied to them by first one manual-respiration method and then another—an experiment that involved keeping the men under curare and an anesthetic for an hour.

Everything went all right—except that three out of 10 trials of the Schafer method had to be discontinued because the pa-

[Continued on page 260]

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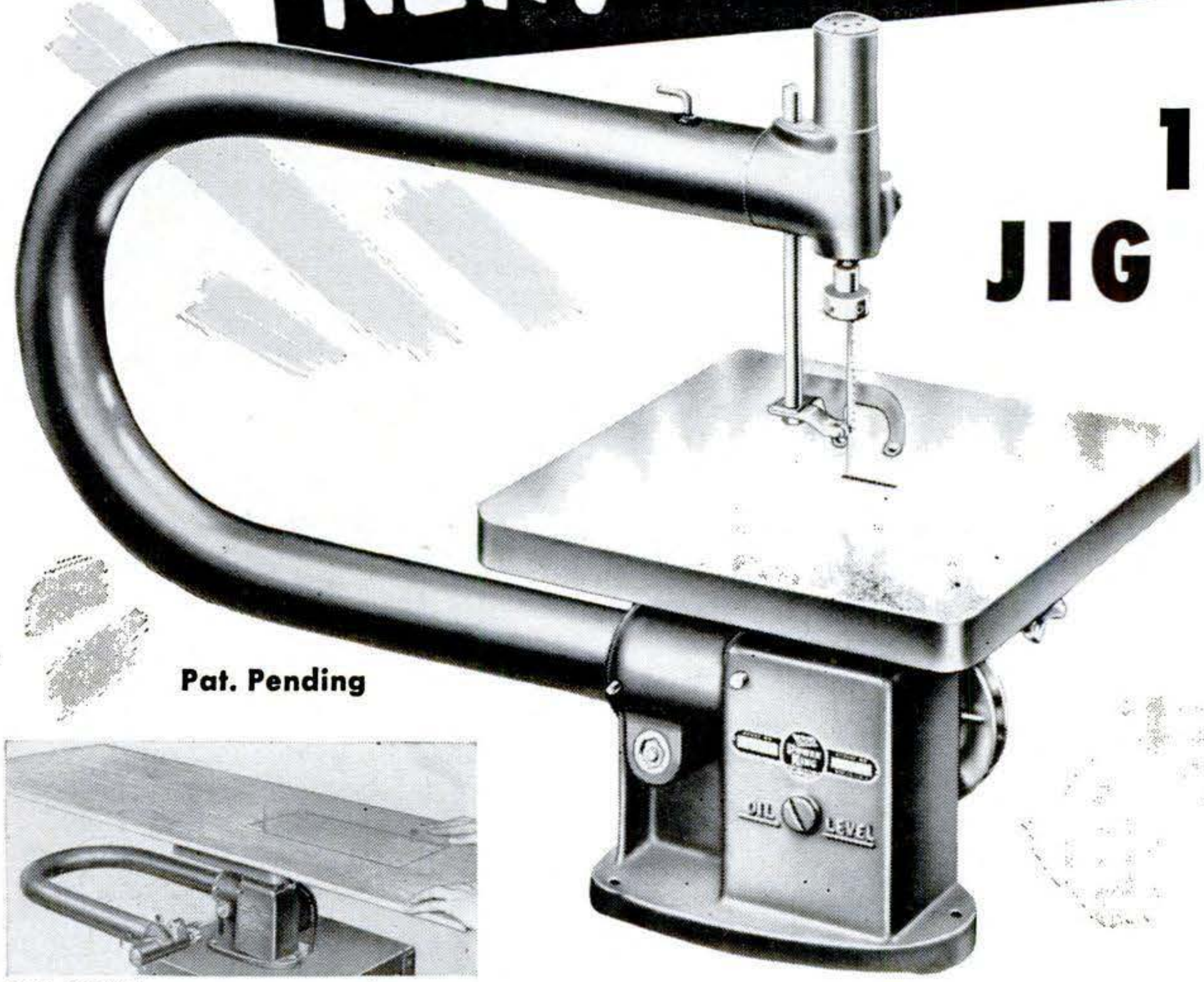
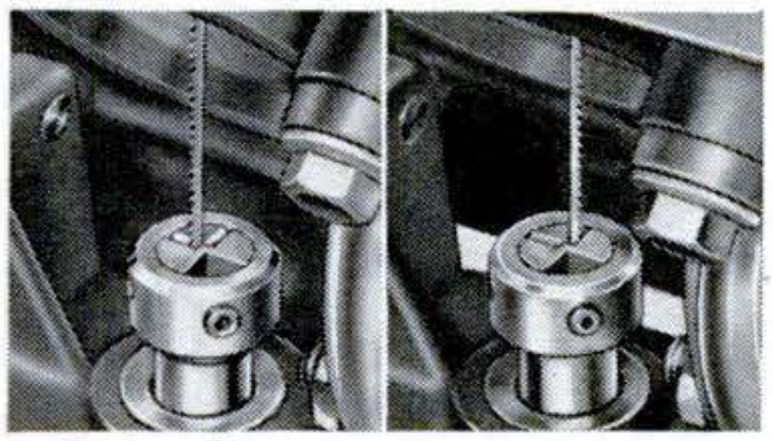
NEW! Atlas-POWER KING

18″ JIG SAW

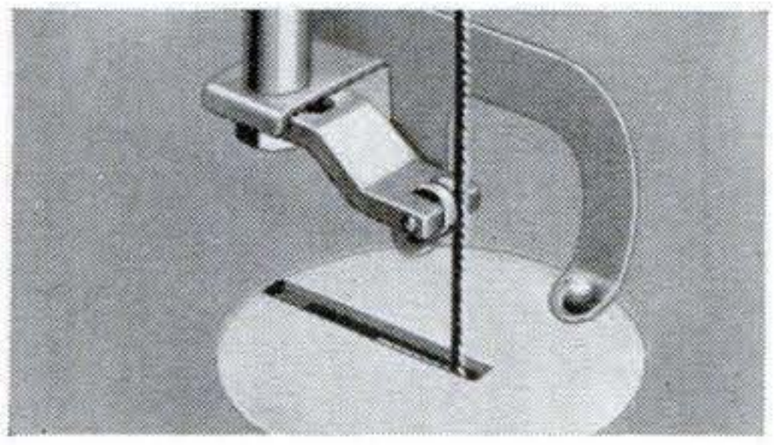


Pat. Pending

LOOK! Overarm turns down out of way *in seconds* for saber cutting large boards and panels — *an exclusive feature!*



LOOK! Chucks hold *all* blades and sabers up to 5/16″ wide, files up to 1/4″ shanks. *No indexing*—slots hold blades at 0° or 90°.



LOOK! Blade support-guide *spins* with blade — *prolongs wear.* Hold-down keeps work against table regardless of angle of tilt.

Revolutionary New Engineering Gives You Unheard-of Performance!

The new Atlas-Power King is a sensational tool development that gives you faster setups and smoother jig sawing than you ever dreamed possible.

The overarm swings out of way for saber-cutting large boards, panels. Takes but seconds . . . no other jig saw has it! Exclusive universal chucks hold all blades and sabers up to 5/16″ wide, files and accessories up to 1/4″ shank! No extra chucks or adapters to buy and fuss with.

Precision ground 11″ x 11″ tilting table, automotive-type bearings, 2″ depth capacity. See all the features at your Power King dealer's.

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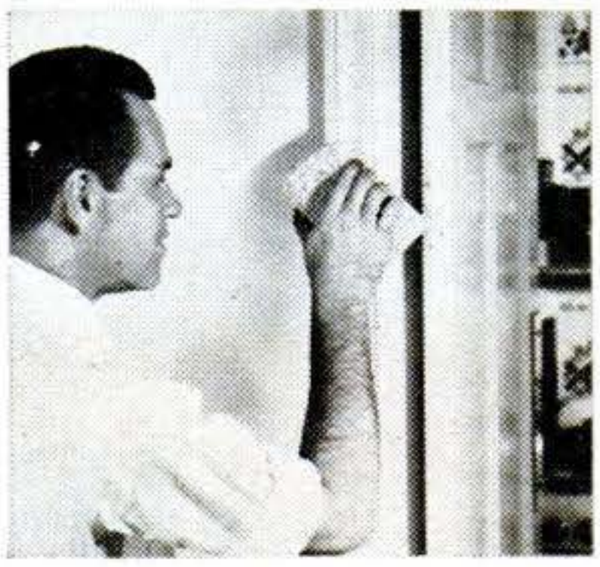
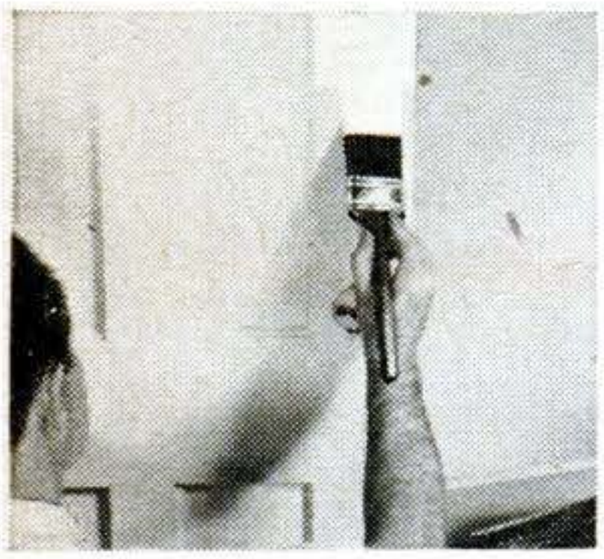
Pointers for home painters Woodwork:

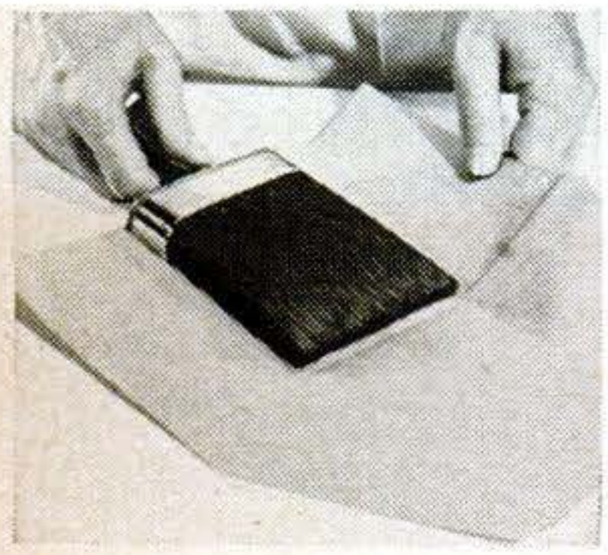


Before painting woodwork, remove all grease and oils so fresh coat will stick better. Use one cup of baking soda to one quart of water. Rinse with fresh water.

If painting over previously stained surface, first sandpaper, dust, then apply prime coat of aluminum paint. Use a nylon-bristled brush for best results.



For neatest work remove doorknobs and hardware before painting. Cut paint odors by placing ammonia in pan of water on floor.



When storing brushes for long periods, clean thoroughly and wrap securely in heavy paper as shown here. Brushes stay in better condition when they're kept in shape.

JOB AFTER JOB you'll get best results with a well-tipped nylon paint brush. Durable Du Pont nylon bristles paint smoother . . . are clean and sanitary . . . never get brittle . . . don't break off even under the roughest treatment. And nylon bristles last from 3 to 5 times longer than ordinary bristles. Leading manufacturers make nylon paint brushes in all types and sizes. Look for the name NYLON on the handle. Be sure to pick the size brush designed for the job . . . and demand Du Pont nylon bristles.

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The best brushes have
DU PONT NYLON BRISTLES

New Method Makes Lifesaving Easier

[Continued from page 258]

tients got alarmingly blue in the face from lack of oxygen. Furthermore, when the blood samples were studied, it was found that in three other trials the Schafer method had produced oxygen levels ranging from 42 to 61 percent, whereas in healthy persons they are around 95 or 98 percent.

Push-pull methods used on the same victims during the same hour produced adequate oxygen levels. In the case of the Nielsen method, these ranged from 89 percent to 100.

Which Is Easiest to Learn?

Obviously, the Schafer method ought to be discarded, and Dr. Dill's research teams ruled out the Silvester method, too. That left the Nielsen and one other technique. It also left a big question: Which, if any, of these methods can most people learn quickly, and perform without tiring?

Under the direction of Dr. Karpovich, 100 boys from Wilbraham Academy and 67 young men from Springfield College were taught a variety of methods, told to demonstrate each one, and then asked how easy they had found them to learn and to do. Dr. Karpovich also measured the amount of oxygen consumed by a group of operators as they performed each method. On the basis of these tests, he favored the Nielsen method.

Nielsen Method Is Adopted

Late last Spring, Dr. Karpovich collaborated with the Gordon-Ivy group in an even wider study of these practical aspects. The guinea pigs were 667 naval recruits and 124 Waves at the Great Lakes Naval Training Center. These watched brief demonstrations of the techniques in question, then performed each one under the eyes of monitors. Conclusion: The Nielsen method is the easiest to perform, the easiest for the instructor to correct, and the most correctly performed.

Last June the investigators unanimously recommended that the Nielsen method be adopted for military use. Civilian lifesaving agencies joined the military services in adopting it officially last December 6. Twelve days later the man who had developed it was 85 and, Copenhagen reported, still active in recruiting students of his technique. There will be 20,000,000 of them in America this summer. END

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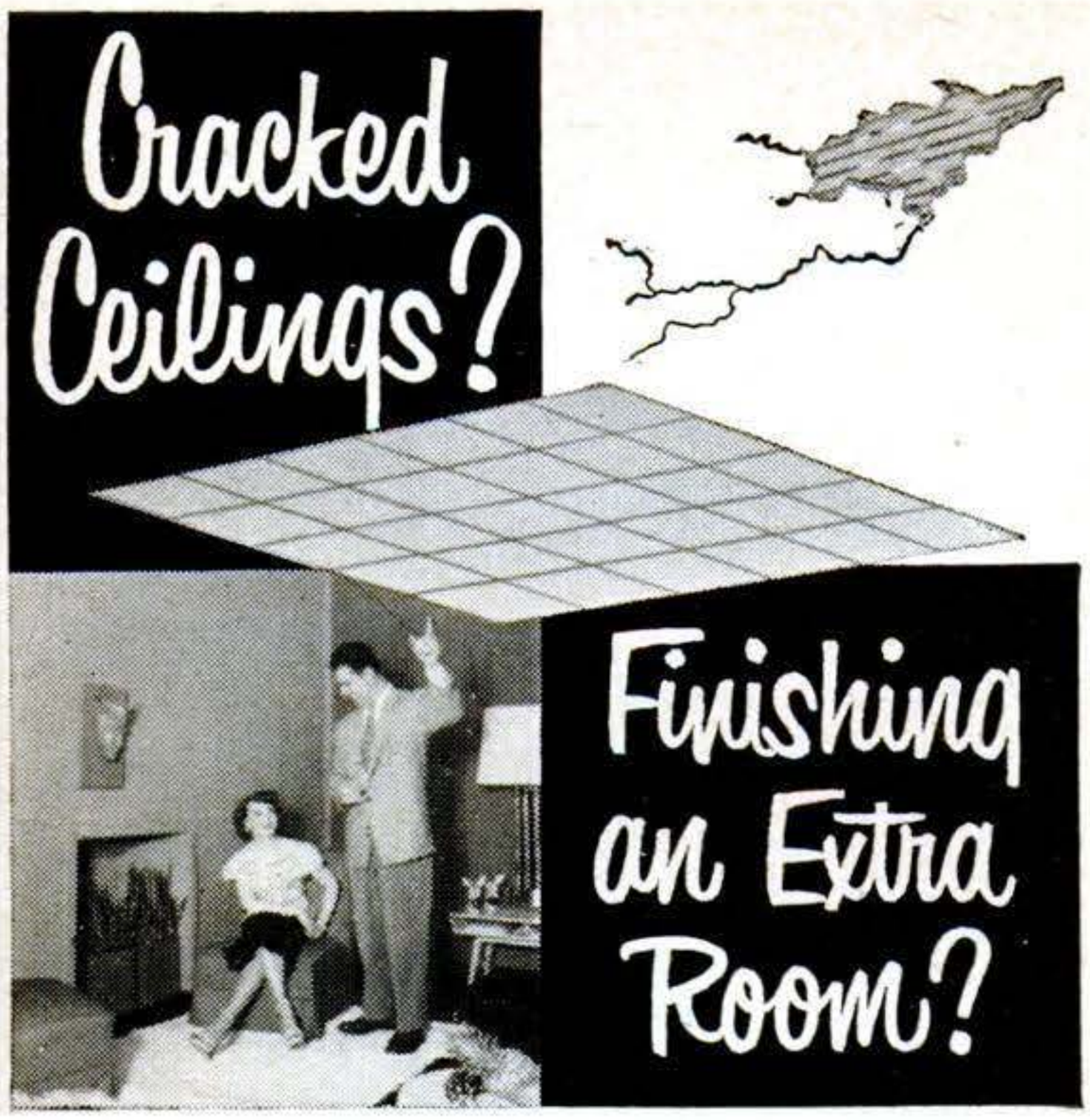

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New Suits Stay Pressed All Summer

[Continued from page 109]

tropical worsteds to heavy winter tweeds.

The acrylic fibers differ somewhat in chemical composition, but all have what is known as "bulking power." This means that they can be made into warm, woolly, high-nap fabrics which will outwear wool and are 20 to 30 percent lighter in weight. From these chemical fibers, country tweeds can be made, in all patterns and weights, that are practically indistinguishable from the product of the sheep. Wool-like socks, sweaters, plaid "lumberjack" shirts, ski suits, long winter underwear, and other outdoor sport or work garments with the same merits can be made.

Used in Homes, Too

Not all these garments will be ready next year or the year after, for substantial production of the synthetic fibers is just getting underway, and there is a big demand for them for industrial and home-decoration purposes as well as for clothing. With quantity production, prices should easily compete with natural wool, and will be more stable, since chemical plants are not affected by cold spells, droughts, animal diseases and other factors which cause wide fluctuation in wool prices.

Consumers are reaping indirect benefits from the new man-made fabrics as their popularity spurs the fabricators of natural materials to improve their products. Leading firms are spending millions on various chemical dipping processes, which at a cost, make cotton or wool cloth water-repellent, fire-retardant, wrinkle-resistant, mothproof, shrink-resistant, mildew-resistant and virtually immune from stain or sunrot.

Treated Wool Won't Shrink

If you take a pair of woolen socks and treat one of them with the Monsanto Chemical Co.'s melamine-resin process (called Resloom), then wash the pair and let them dry naturally, the treated sock remains the same length while the untreated one may shrink as much as two inches. This process is now being widely used to control wool shrinkage, and American Cyanamid and U.S. Rubber have developed similar methods.

The man who wears the clothes will choose among the competing new fabrics and processes; however his vote goes, he will be better groomed with less trouble and expense. END

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This General Motors-Allison Centrifugal Pump—designed for use on U. S. Air Force Mustang fighters, now converted for commercial, home, and industrial high volume pumping applications. Inlet, 2½" standard pipe thread, twin outlets with 1¼" pipe thread, ball bearing supported ¾" shaft. Easy, fast simple priming. Rotation, counter-clockwise facing shaft. Shipping wt. 35 lbs. Gov't acq. cost $145.00.

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Item #182

Item #199—Power Unit PE-99—7.5 KW—120 Volt—Single and 3 Phase—60 Cycle, A.C. Master generator driven by a 4 cylinder, V-type, air cooled Wisconsin engine with magneto ignition, push button start. The self-excited, drip-proof generator is driven from 5 parallel V-belts. Control panel contains engine and generator instruments, including circuit breaker, emergency start-stop buttons, voltmeter, ammeters. Complete semi-enclosed units mounted on steel skid. Weight 1885 lbs. F.O.B. Chicago..... **945.00**

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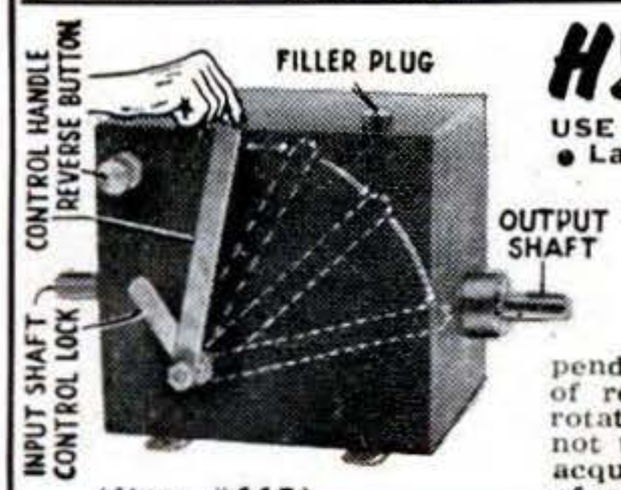
ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 PSI line pressure is 12,500 lbs. Ship. wt. 30 lbs. F.O.B. Chicago. An Excellent Buy for..... **32.50**



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This Westinghouse-Oil Gear Unit converted to commercial use from 40 MM anti-aircraft traversing mechanisms consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation. Both input and output shafts measure ⅝" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speeds not to exceed 750 R.P.M. Over-all dimensions 7½"x7½"x11½". Gov't. acquisition cost, $428.00. Shipping weight 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago..... **54.50**

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What Will We Do with the Moon?

[*Continued from page 167*]

two major problems of life on the Moon would be solved. We may safely assume that by the time lunar expeditions are feasible it will be possible to generate electrical power on a large scale from nuclear sources. The power unit of an atomic rocket would provide ample energy to run turbines and generators.

There is a good deal to be said for moving the Lunar Base underground at the earliest opportunity, if it proves possible to excavate the Moon's surface rocks without too much difficulty. An underground settlement would be easy to air- and temperature-condition, and its construction would not involve carrying materials from Earth.

Moon Water Could Be Rocket Fuel

After air and water—perhaps even before—the search would be for material from which rocket fuel could be obtained. Water may again provide the answer. It is a possible (though not the best) propellant for atomic rockets. Electrolyzed to provide hydrogen and oxygen, it could drive conventional chemical rockets. Once it became possible to refuel on the Moon, the whole picture would change and the economics of space flight would improve by a factor of 10 or more.

A spaceship leaving the Earth has to attain a speed of 26,000 miles an hour in order for it to "coast" to Venus by the most economical route. If it left the Moon, the starting speed would have to be only 7,000 miles an hour because of our satellite's much lower gravity. If large supplies of fuel can ever be obtained on the Moon, it would become the key to the Solar System. Spaceships making any interplanetary journey would, on departure and arrival, refuel there. They would probably not land but would orbit the Moon while specially developed short-range ferry rockets brought fuel up to them.

Fuel Ships Launched from Moon

It would even be good economics to refuel, *from the Moon*, spaceships that had just reached orbital velocity *around the Earth* and were circling it outside the atmosphere. Carrying rocket fuel the quarter of a million miles from the Moon would be cheaper than lifting it the few hundred miles up from Earth.

[*Continued on page 266*]

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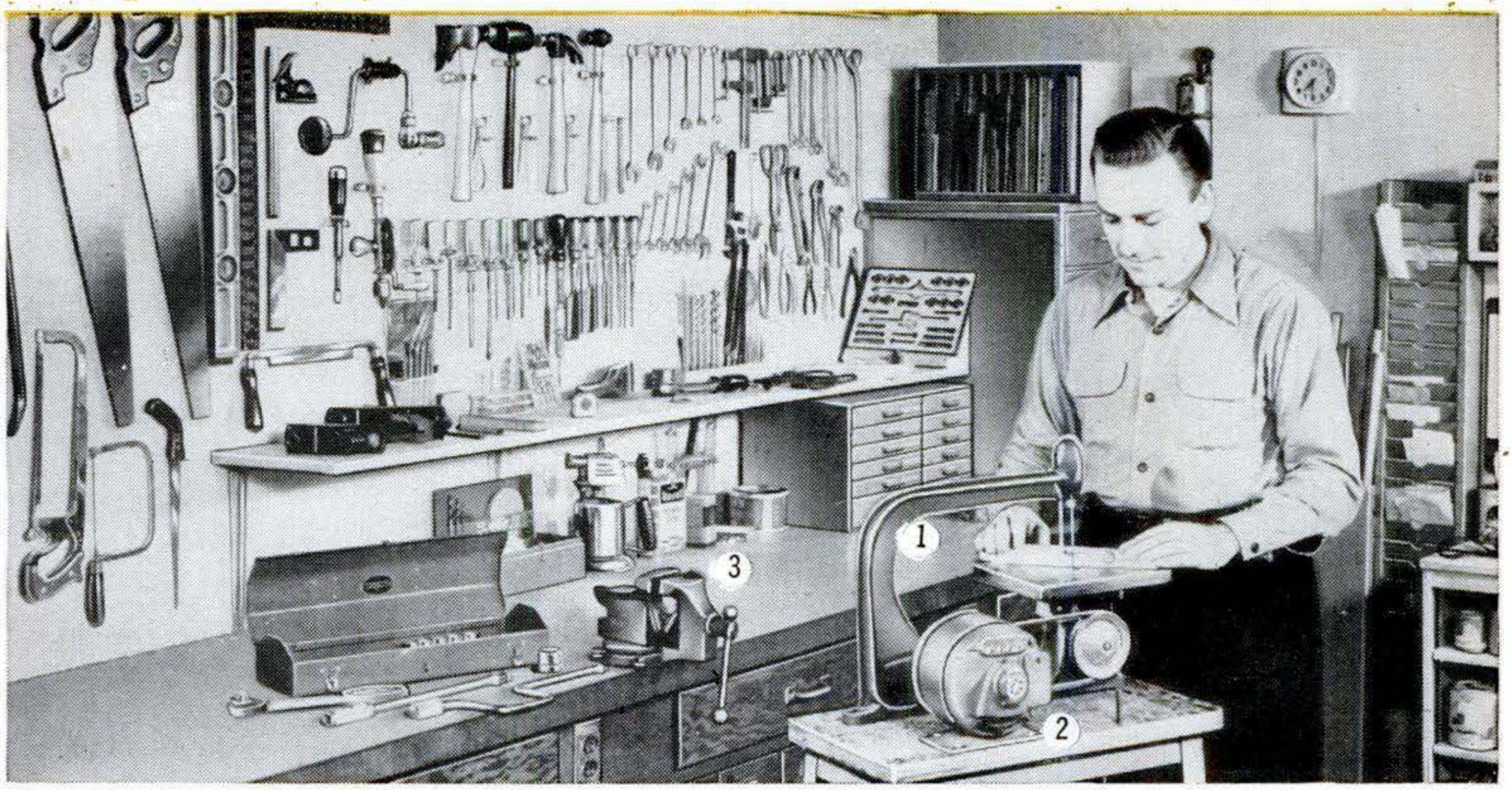

Just one visit to Western Auto will prove to you that famous, professional-quality Westcraft Tools give you the same lasting accuracy of other brands costing far more. Every Westcraft Tool is precision-built, fully-guaranteed . . . the kind of tool you'll be proud to own. And they're yours on easy Western Auto terms. See, try and compare Westcraft this week!

① **Tilt Table Jig Saw** does accurate jig, scroll, sabre sawing in wood and plastics to 1" thick. Scotch yoke, oil-ite bearings. 5" blade, adjustable guides..... (2H1102) **$19.35**

② **¼ HP Electric Motor,** 1725 rpm, 115 volt, 60 cycle AC. Split phase. GE guaranteed for 1 year. Use with jig saw, washer, churn, paint sprayer, etc..... (2H1600) **$17.25**

③ **Mechanic's Vise,** 3½" jaws open to 4½". Removable pipe jaws and face plates. 180° swivel base. ⅝" acme threaded feed screw. Weighs 17 lbs..... (4HR4836) **$6.25**

Soldering Iron, 100 watt. Many home uses. Fast-heating nickel chrome sealed-in element lasts longer. 6-ft. heavy duty cord. Only. (4HR4316) **$2.00**

"Loc-Grip" Plier. 1500-lb. grip. Use with ratchet action or as lock-on handle. Narrow steel jaws, hardened and tempered. Only (HR1205) **$1.98**

Screwdriver, alloy steel, chrome-plated. 4" sq. blade. Extra long, positive-grip handle. Professional quality. Yours for (HR1361) **85¢**

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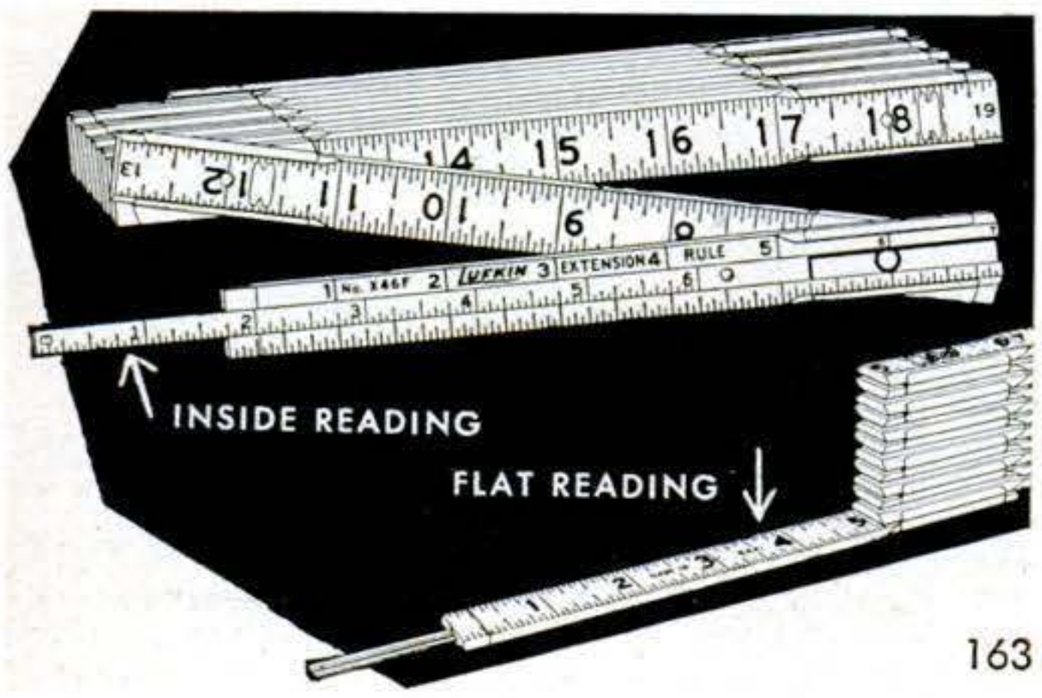

Measuring begins at extension end of rule on both sides of this new extension rule. One side allows rule to be used *flat* against work. The sliding brass extension permits accurate inside measurements. A sturdy, rigid, accurate rule. LUFKIN "RED END" quality throughout. See this new rule at your dealer's!

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What Will We Do with the Moon?

[Continued from page 264]

If one wished to project anything away from the Moon, it would be much more economical to do this by means of a fixed ground installation (which could also have no restrictions on weight) than by any kind of rocket device. It would be impracticable to use such a launcher for manned spaceships because the restricted accelerations needed would mean that it would have to be about 100 miles long. But fuel containers, if properly designed, could withstand accelerations of perhaps 100 gravities and could be hurled into space by a launcher only two miles long. They would then be intercepted when they were at their furthest point from the Moon and traveling quite slowly with respect to spaceships circling in an orbit at this distance.

Food Will Be a Problem

The provision of food for the colony is a complex problem. There are two obvious lines of attack—pure chemical synthesis, or hydroponic farming. Both solutions are probably practicable, or will be by the time the need for them arises.

It is not even totally impossible that, provided suitable soil can be found or manufactured, plants could be developed—perhaps from the native lunar vegetation, if this indeed exists—which would flourish unprotected on the Moon's surface.

Lunar Railway Foreseen

Until we know the answers to such questions as these, we cannot say whether the future population of the Moon is likely to be a few score scientists—or millions of men and women living comfortable and, to them, quite normal family lives in huge, totally enclosed cities.

Since conventional flying machines obviously cannot operate on the airless Moon, long-range lunar transport presents something of a problem. Rockets would almost certainly be uneconomic for short distances, and it appears quite likely that railways would be extensively used. Pressurized vehicles with large balloon tires would also be employed for much the same duties that they fulfill on Earth. Their motors would be electric, operated by storage batteries, or else turbines, driven by reacting rocket fuels, either directly as in a gas turbine, or indirectly through the use of some intermediate fluid. END

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The most practical power tool addition to your workshop. Enables you to "cut corners" on many woodworking operations! Versatile, convenient and dependable, will increase workshop efficiency and improve work quality. Has many features ordinarily found on higher priced tools: ball bearing blade guides above and below table keep blade running truer and smoother; double trunnion table supports; balanced disc wheels; roller type bearings. Work table tilts to 45°. One piece guard covers both wheels, has provision for built in light, unlocks easily, allows operator to check blade tension and tracking quickly, safely. Also permits easier blade changing. Can be used for metal cutting with special converter. There's a Duro Band Saw for every purpose in 10", 12", 15" and 16" models.

A NEW KIND OF PROJECT MAGAZINE

A treasure of project ideas. Prepared by a practical craftsman. Refreshingly new material — with photographs, plan drawings, step by step instructions, that even a beginner can follow easily. Send 25c for sample copy, or you can save ⅓ and get 6 issues for $1. Either way we'll refund your money if not delighted.

Write Today!

For full details and specifications on the Duro 10", 12", 15" and 16" Band Saws and full story on the complete line of Duro power tools.

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Please send me full details about the new Duro Band Saws.
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Also Makers of Duro-Chrome Hand Tools

Sands, Cleans, Smooths, Polishes Electrically

Designed for industry, for professional work, this light, beautifully balanced, orbital-motion, SpeedSander is rapidly becoming a standard home appliance. With its powerful electric motor and all-ball-bearing construction, anyone can easily re-surface and refinish furniture, woodwork, metal surfaces or walls. It will quickly remove old paint, stain, or enamel down to the bare wood or metal; will sandpaper to a "piano finish"; remove rust and corrosion or "feather edge" a scraped fender. It will burnish pots and pans or with lambs wool bonnet, delicately polish fine furniture. It makes tedious, tiresome jobs fun—saves hands! In design, convenience and efficiency it is today's finest sander regardless of price. Ask your local dealer to demonstrate it.

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INSTANT PAINT BRUSH CLEANER

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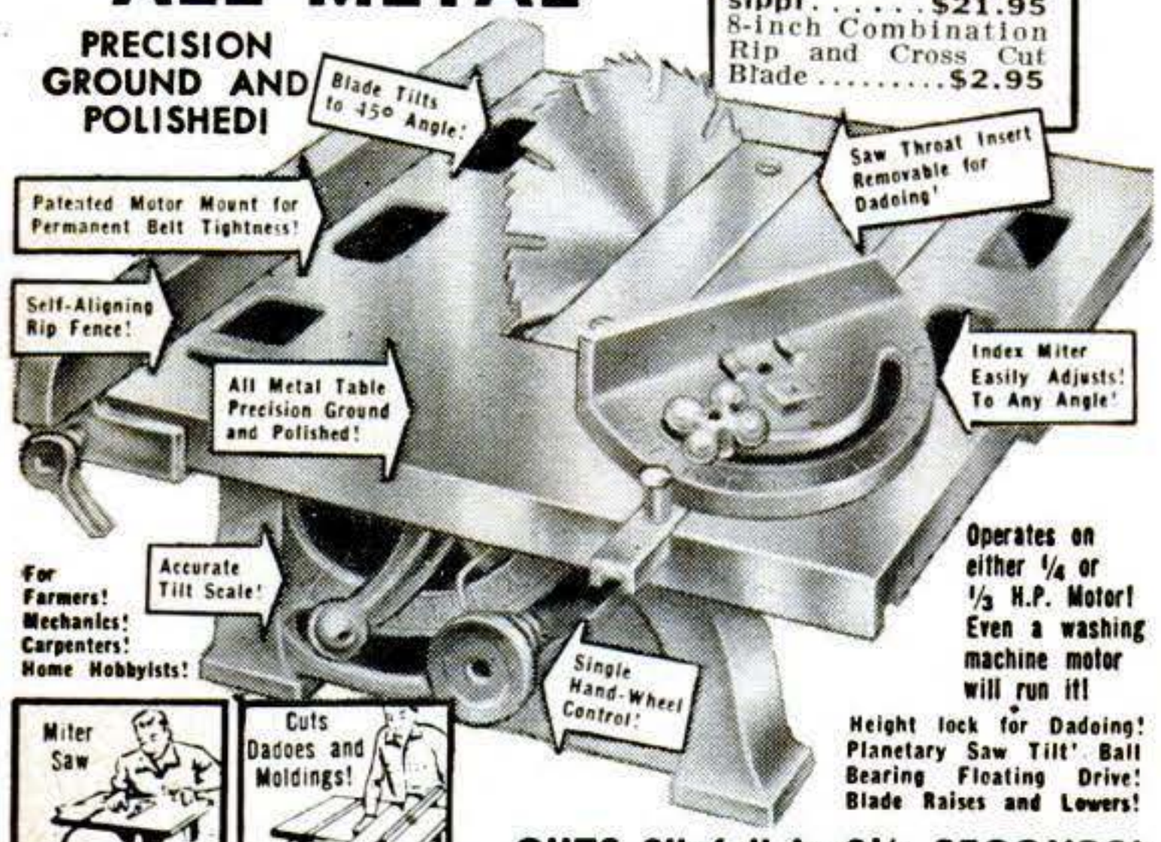

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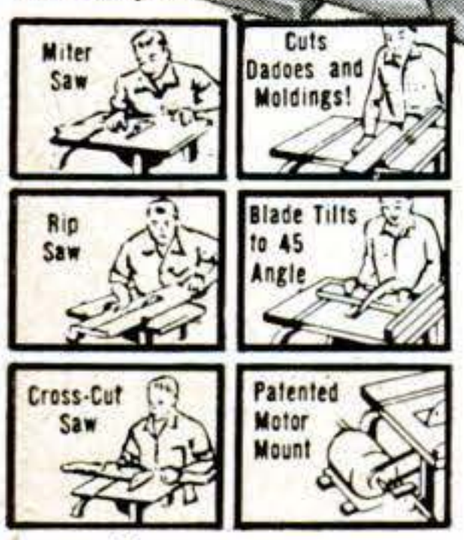

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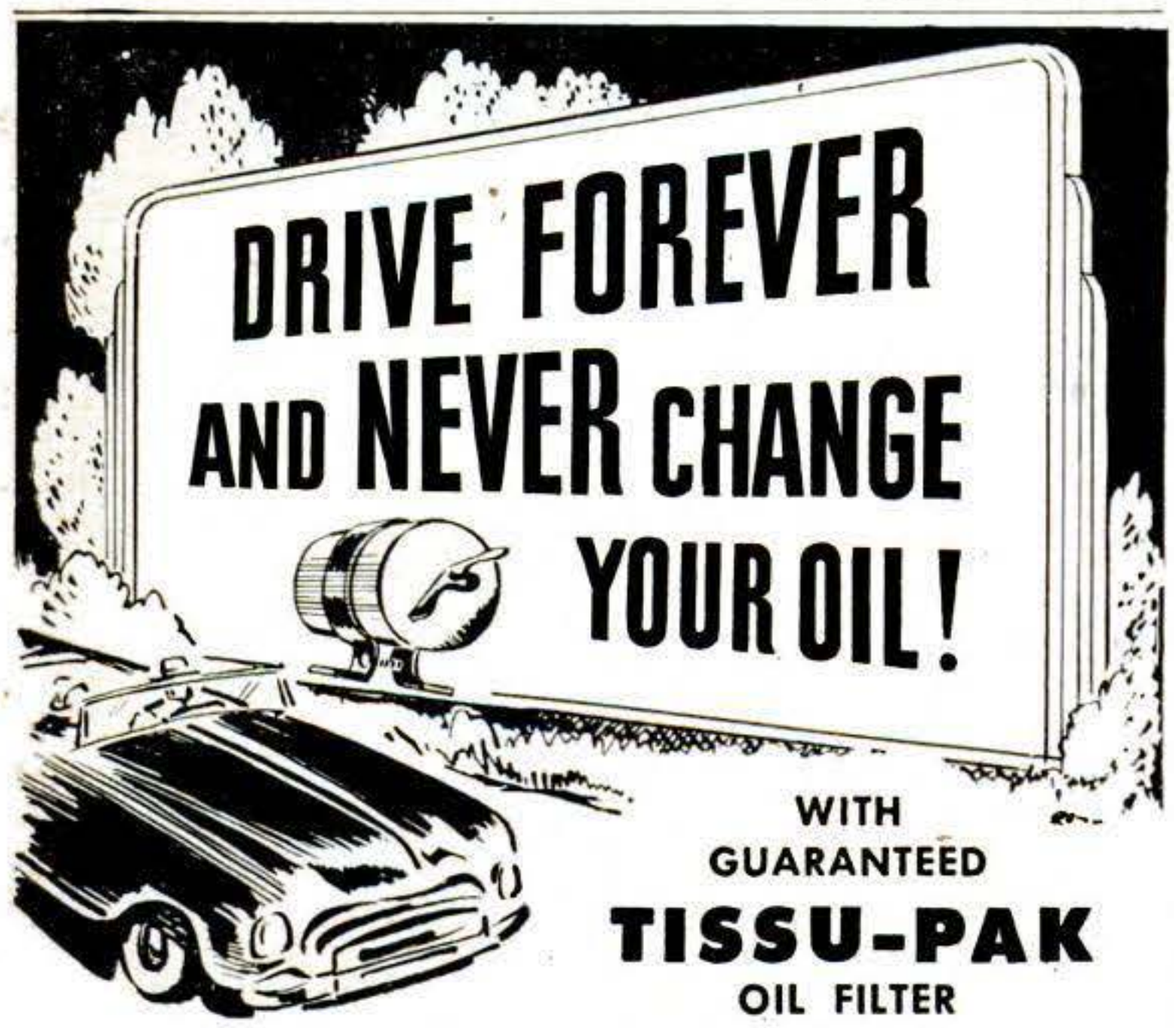

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How I Drilled a Well

[Continued from page 181]

to get 100 r.p.m. on the drum. The answer was a trip to the local washing-machine shop where $2 bought a heavy-duty, ball-bearing worm reduction with a ratio of 19 to 1. The rest was simple. A cast-iron pulley was mounted on a mail-order saw mandrel for the drum. Maple blocks and an old refrigerator base provided the structural members, and a cedar post and a large scrap timber served as skids. Holding the machinery down was a serious problem until I ran two lengths of steel fence post from the A frame to the rig base. A washtub full of boulders gave the needed stability to the skids on the rear end.

Clutch. It became apparent that an occasional tangled rope could be expected, and that I would need some means of reversing the drum by hand to untangle it. A centrifugal clutch on the engine shaft provided the reversing and also saved trouble when starting the engine, making an extra clutch or belt tightener unnecessary.

The space between the flanges of the drum should be wide enough to take about three turns of the rope without wedging. When the rope gets wet and starts to jam, the resulting tangle can put a backlash on a bait-casting reel to shame in a hurry. Use bolts and fittings that tend toward the brutal side. Put lock washers under all nuts. Some form of safety device is important, so don't overlook one reliable built-in weak spot, such as a soft-iron shear pin between the drum and the shaft. When four or five horsepower is geared down at 19 to 1, it can tear things up badly in a few seconds.

Where to drill. Location of the well is worth pondering. With a new house, it is a common temptation to drill in the basement and then build the house above. But at a future date you may have to pull 21′ lengths of suction pipe for servicing in a basement that is only 7′ or 8′ high.

If you plan to bring your well pipes into a pit out in the yard, with the pump mounted in the pit, you'd do well to consult your local codes. Some areas will not permit well pits at all, and others permit them only when they are nicely made of poured concrete with proper venting and drainage. The reason is that a defective pit can act as a sump to collect surface contamination.

Pits, of course, originated with the idea of protecting the pump and system from freezing, always a problem if a well house is used.

[Continued on page 270]

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Will weld, braze, solder and cut all metals up to 3/16". No experience needed, full instructions included. Weld iron, steel, brass, aluminum and other metals. Plug into any 110 Volt A.C. or D.C. line. Save hundreds of hours and money doing repair work for yourself and others. A great item for any mechanic or hobbyist, etc. Not a toy. Comes complete with electrode and carbon holders and an ample supply of electrodes, carbons, flux and necessary components to do a thorough welding job of any type. This unit cannot be duplicated for many times its price. NEW—price **$12.00.**

HIGH SPEED DRILLS

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from 45 to 60. Well-known brand, highest quality steel. Hard to get sizes. A $7.50 value. Set of 12, all of 'em for only $2.00! **NEW**

RIVET SETS

Universal type, case hardened tips. Set of dies will head up only brazier or round head rivet from 1 1/6" to 1/4". With adapters for air gun or hand use. All new—cost Govt. approx. $27.00. Complete 15 piece set (wt. 2 lbs.)__**$5.00**

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This U.S. Gauge Altimeter is terrific for auto or airplane. Tells altitude accurately . . . guaranteed. It's NEW! Approx. Govt. Cost $175. Cost from Airborne only **$9.95.**

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10 different size H S Straight Shank Jobber Length Drills, 1/4" to 1/2". (shank same diameter as drill) $25 value NEW—**$3.50.**

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SET from 1/4" to 33/64", 5 sizes with 1/4" Shanks—NEW—get this, **$3.00** takes this set!

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"C" Yoke Head. Size PRS-1. Model 4520. Shpg. Wt. 20 lbs. Approx. Govt. Cost $250. Like new — guaranteed perfect! Just _____**$35.00.**

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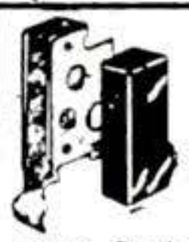

Type Z—2" x 1". Used open or closed. For automatic contacting . . . light, sound, model train systems, chimes, etc. NEW! 5 for **$2.** Aluminum Spring Actuator to fit above Microswitch_____5 for **$2.**

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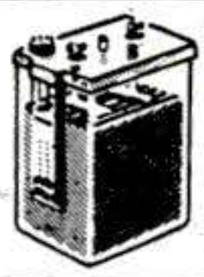

Extra-long life, rechargeable battery. 2 V., 20 Amps. Great for portable radios, mobile units, bell circuits, alarm systems, rural telephones, Strobo bulbs, etc. Only 5" high. Visible ball float hydrometer built in Lucite case. Shipped dry (wt. 3½ lbs.) . . . any battery service will supply standard battery electrolyte. Used singly or in multiples. ALL NEW! Now only **$1.95** ea.

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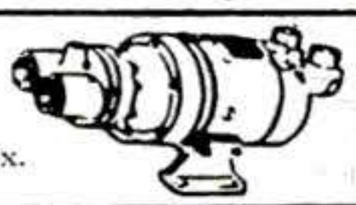

Pump has 1" connections, built-in relief valve, adjustable up to 1500 lbs. Max. capacity 6 GPM. 1½ H.P., 24-volt motor. 4000 RPM. Can be used on 12 or 36 volts. Govt. cost approx. $350—our New Low price **$9.75.**

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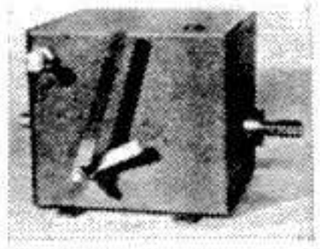

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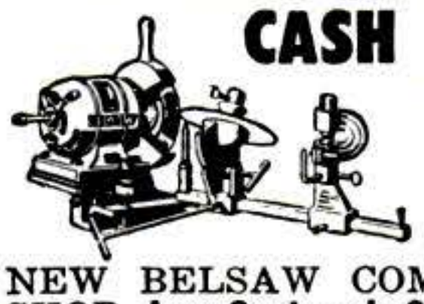

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Hardware is overhead track with ball bearing rollers. *Unconditionally guaranteed* for smooth, silent performance by America's largest manufacturer of Sliding Doors.

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Precision Made for Precision Work

Home craftsmen will find Whiz-Saw useful for rough cutting jobs as well as precision work. Light in weight, but amazingly sturdy. Whiz-Saw quickly cuts wood, bone, plastic, fibre, pressed wood, hard rubber, etc. up to 1" thickness . . . it's scientifically designed for cutting inside shapes without first boring a starting hole. Ideal for jig or band saw use when inserted in handy Whiz-Saw table. See the Whiz-Saw at your dealers. Whiz-Saw Model #2, has greater capacity, cuts up to 2" thickness—$130. Whirl-Saw, a 4½" circular blade, cuts up to 1½" thickness—$49.00. *Send for free booklet.*

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The Forsberg Mfg. Co. Bridgeport, Conn., U.S.A.

the ideal cutting tool for:
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All-metal Whiz-Saw table may be secured with screws to wood bench or held in vise.

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- snow-white blade with bold, legible, jet-black numerals and graduations. Graduated in 32nds for first 6 inches.
- sturdy die-cast case heavily chrome-plated, calibrated for quick reading inside and outside measurements.
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- unheard-of low price*: 10-ft. $1.49; 8-ft. $1.19; 6-ft. 98¢. Prices higher in far west and Canada.

Evans & CO *Sold only through retailers.* Elizabeth, N. J., Montreal, Que.
Makers of Evans 6-ft. Folding Rule and "Folding Yardstick"

How I Drilled a Well

[*Continued from page 268*]

A more desirable method than either of these is to weld an angle take-off pipe at 90° to the casing and lead the suction pipe through the basement wall. Freezing is licked, danger of water in the bottom of the pit seeping into the water supply is eliminated, and no well house clutters up the yard.

With a welded take-off pipe in mind, I picked a well site close to the house at a spot where the pump could be located under the cellar stairs. Such an offset installation requires a shallow-well pump of the straight suction or jet type, if water is available at a high enough level, otherwise a deep-well jet with two pipes (pressure and suction) which can be offset 50′ to 100′ if necessary. The jack-type pump with a cylinder and sucker rods cannot be offset and must be mounted at the wellhead.

NEXT MONTH E. F. Lindsley tells about the headaches and successes involved in bringing in a reliable supply of water.

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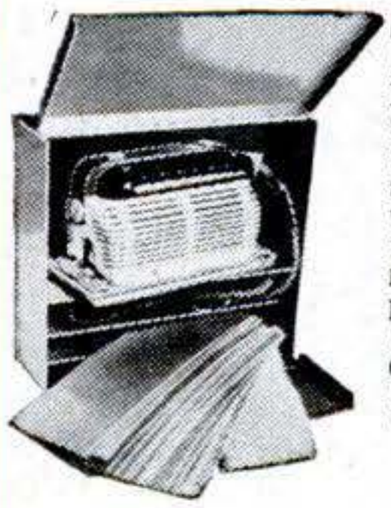


MODEL 2000 PRICE INCLUDES this sturdy steel storage case, 25 asst'd. abrasives, and sheepskin polish pad.

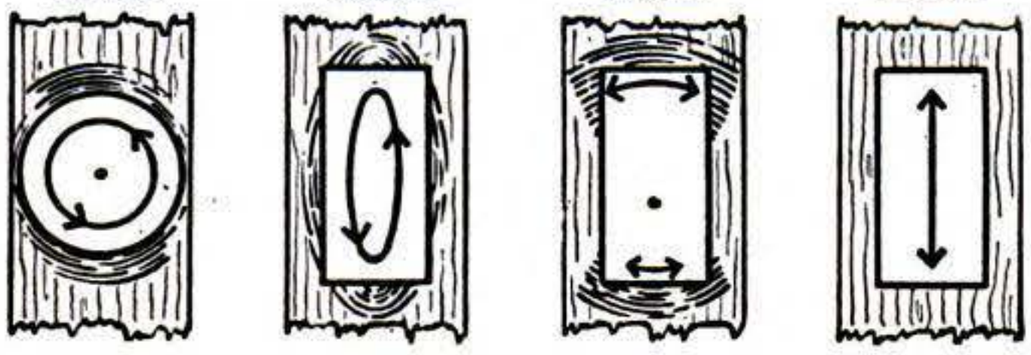
MODEL 2000 FOR HEAVY DUTY CRAFT AND WOODWORKING PROJECTS— If you need ample power for furniture and cabinet making, boat building or refinishing, resurfacing large areas—for building operations like woodwork, stairs, dry-wall joints, siding, etc.—the model 2000 will fill your needs perfectly. Also does a superb polishing job! It's the fastest seller in the field for rugged power at lowest cost, and users say they have never found a sander that compares with its smooth finishing performance. Weighs only 5 lbs., has 21 sq. in. of sanding surface; over-all size 3⅛" x 4½" x 7". Comes to you complete with accessories in the *all-metal storage-carrying case shown at left.*

14,400 SANDING STROKES PER MIN.

ONLY STRAIGHT-LINE ACTION SANDS WITH THE GRAIN

Ask any professional woodworker about sanding action. He will tell you that only straight-line, with-the-grain sanding can produce a flawless finish. Follow his advice—insist on Dremel.

BEFORE YOU BUY ANY SANDER . . . COMPARE!



MODEL "A" FOR HOBBIES, REFINISHING, REDECORATING—Dremel's lighter capacity, excellent all-purpose sander for home maintenance, unfinished furniture, hobby projects, etc. Wonderful wax polisher. A soothing massager! Only 2½ lbs. with 12" sanding surface.

MODEL "A"
$14.85
Price includes 6 sandpapers, 1 sheepskin 1 felt pad.

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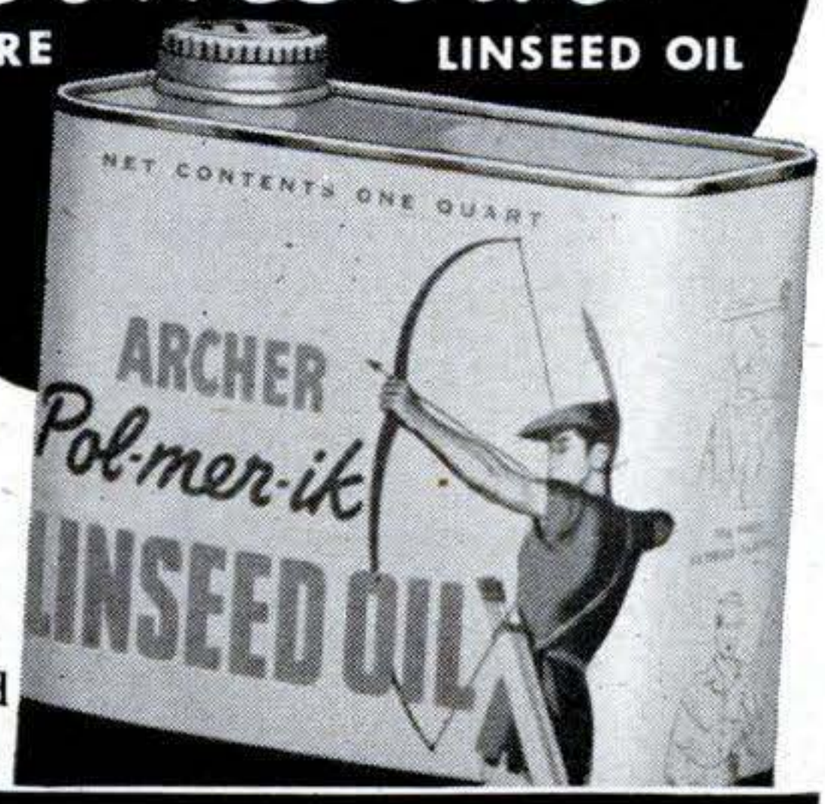
100% PURE LINSEED OIL



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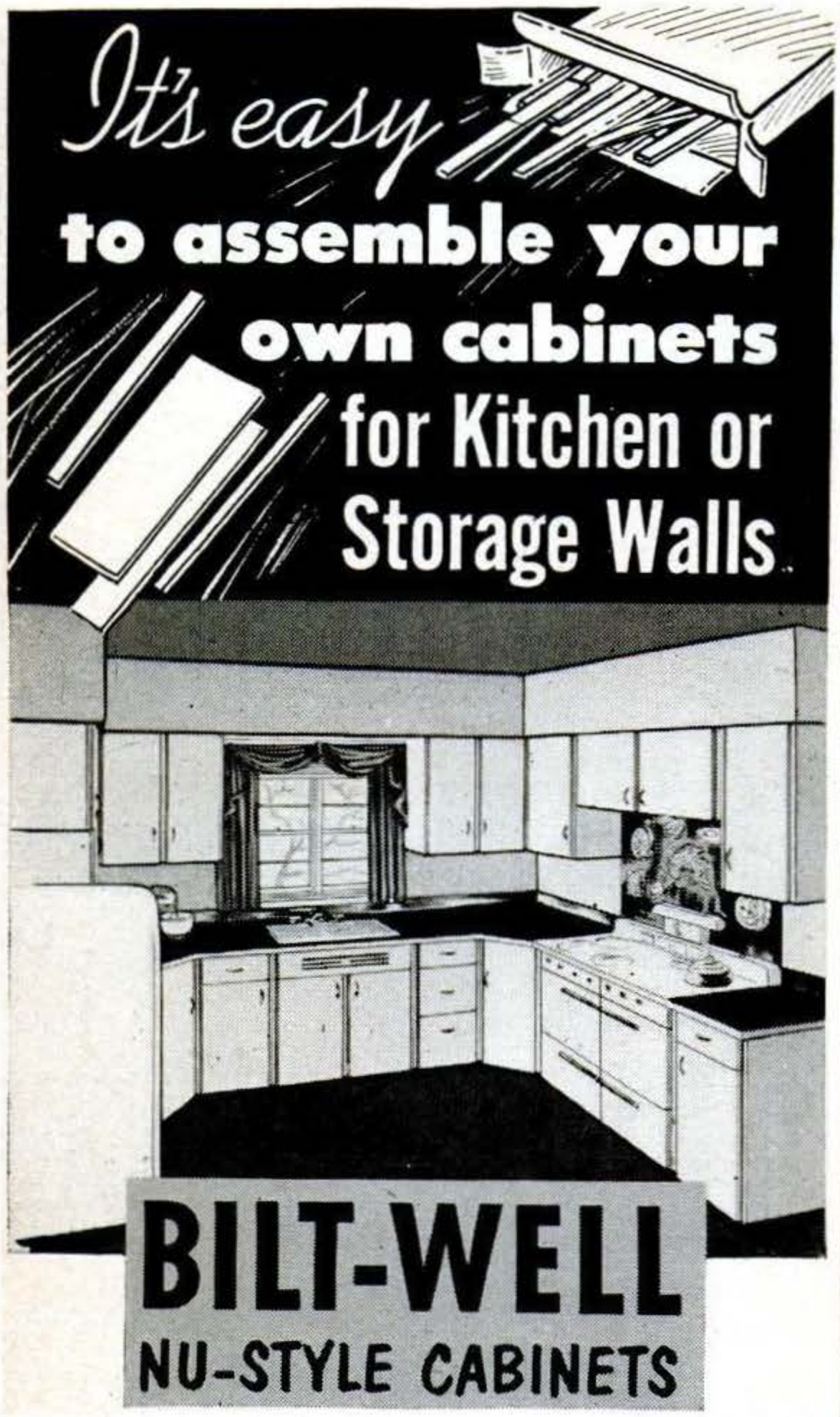

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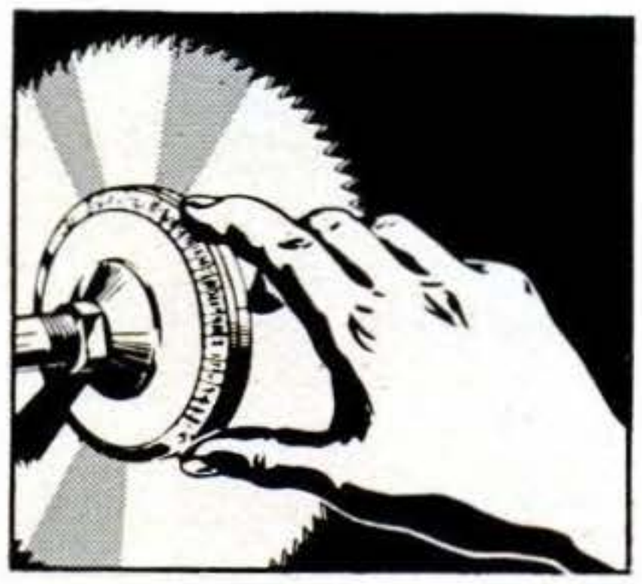
Warren **DADO SAWING WASHERS**



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Make clean, smooth parallel grooves at any angle—no chewing, no sanding. Just dial your cut—no trick screws, no vibration, strengthens blade for straight cuts. Warren Washers greatest improvement in 30 years—and most copied—look for the name on the box and washers. It costs no more to get the best—WARREN, IT'S GUARANTEED! At your dealer or order direct. Give arbor size—½", ¾", ⅝", 1"—sent postpaid.

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AMAZING 12¼-IN. PLANER Does All Ordinary Planing Mill Jobs. Provides attachments for Jointing, Rabbeting, Tongue, Groove, Matching. 12¼ x 6-in. capacity, 3-knife solid round all-steel cutterhead. Power feeds at 24 feet per minute, 42 cuts per inch. Provides for full line of accessory attachments—Grind and Joint knives IN THE CUTTERHEAD WITHOUT REMOVING.

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ADJUST—LOCK—RELEASE With One Hand
Gripso's safety **"TRIGGER"** Release is outstanding **SAFETY** feature found in no other similar tool. Pulling trigger alone will **NOT** unlock jaws. Pull trigger, squeeze handles and pressure releases evenly under your direct control. **NO** leaping apart of handles, **NO** skinned knuckles. Length 8".

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SET 9Z 15 different size High Speed Morse Taper Shank Drills up to 9/16", with No. 1 and 2 tapers. New and used. $50 value. Priced at only **$6.49**

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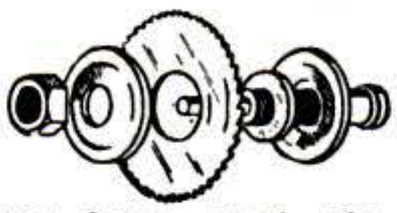
6 Slitting Saws with Mandrel



SET 34Z 6 Different Size High Speed Slitting Saws, 2 3/4" dia. x 1" arbor. Thickness from .040 to .071. Cuts wood, aluminum, brass, steel, etc. PLUS SPECIAL MANDREL which enables use of saws in 1/4" or 1/2" elec. drill. $25 Value. Ppd. Only... **$4.95**

7 selected, sharp H. S. Slitting Saws as above to use on your own mandrel or milling machine. New and used. Ppd. A bargain at..... **$4.95**

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SET 16Z 20 Different Size High Speed Straight Shank Chucking Reamers up to 1/2". New and used Priced at only..... **$7.95**

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Volume 104 cu. in. Max. pressure capacity 500 lbs. Complete with regulator assembly. 500 lb. pres. ga.; belt clamp; excellent for breathing apparatus; compressors; small welders, etc. **$2.95**

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With every PTI blade you buy at the regular price ... you get an extra blade for only $1 more. Ask your dealer.

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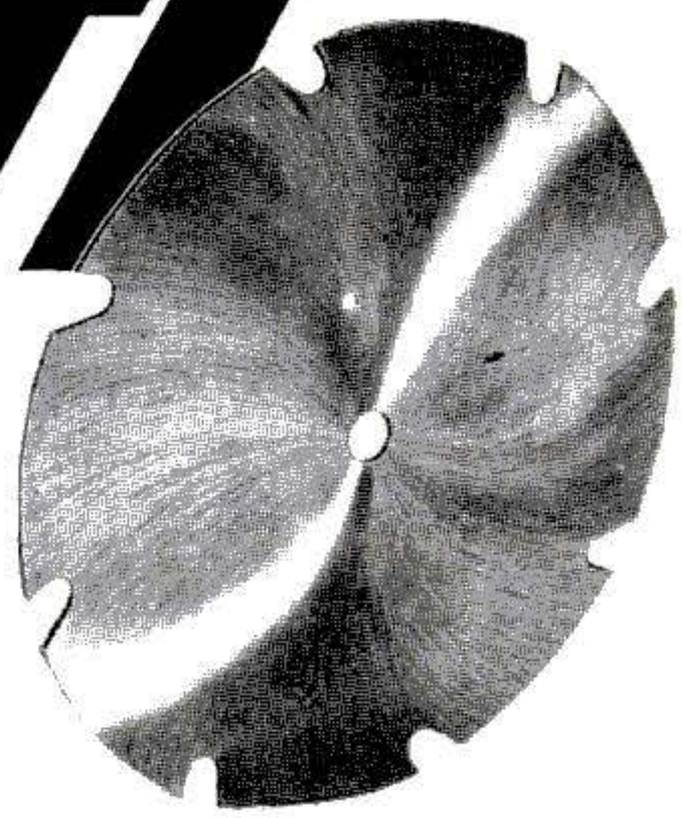

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For a dependable safety saw blade that eliminates "kick-backs" from circular sawing — insist on the genuine PTI blade. (U. S. Pat. No. 2,559,355).

Precision made of chrome vanadium steel by one of the world's leading saw blade manufacturers. Cuts cleaner, quieter, smoother—and requires 30% less power. Available in sizes from 7" to 16" and for standard makes of portable saws.

Write for circular giving full details.

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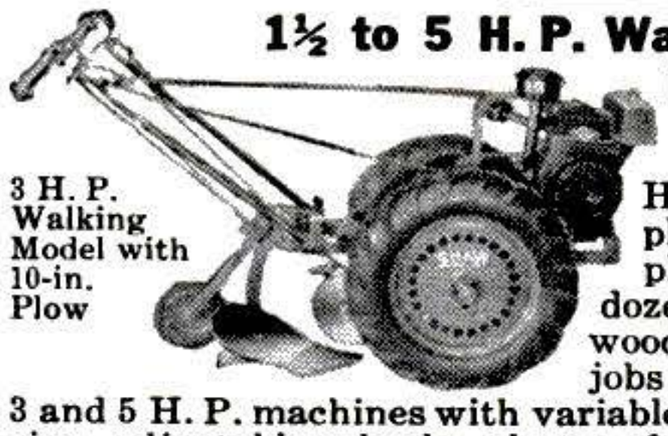

3 H. P. Walking Model with 10-in. Plow

1½ to 5 H. P. Walking Models Do Everything In Gardening

Handle 6, 7, 10-inch plows... cultivate, plant, mow, bulldoze, cut trees, saw wood, do many other jobs fast and easy. 1½, 3 and 5 H. P. machines with variable speed transmission, adjustable wheels, plenty of plant clearance. Power turn models and power take-off attachments available.

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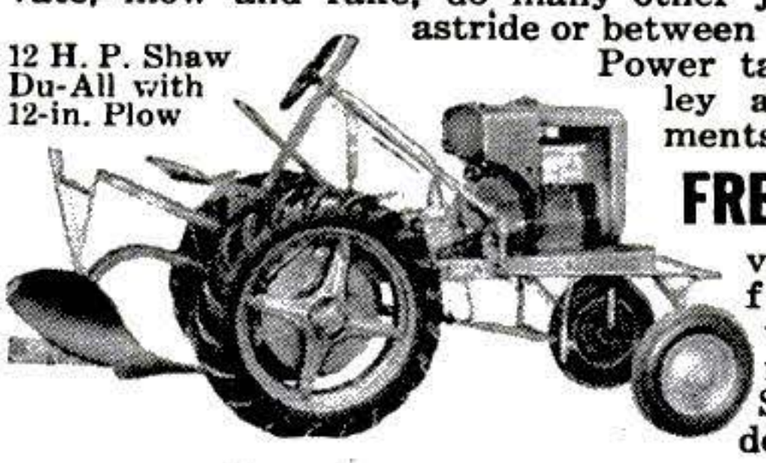

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QUALITY AT LOW COST **SHOP ACCESSORIES** FULLY GUARANTEED

Saw Blades
CHROME : NICKEL : MOLY STEEL
1/2-5/8-3/4" ARBOR

FLAT GROUND
RIP • CROSSCUT • REGULAR OR NOVELTY COMBINATION
6" dia. $1.88 | 8" dia. $2.39
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SEND FOR IT TODAY!
32 PAGES on use of saws, dados, moulding head, sanding discs OVER 100 photographic illustrations
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FOR YOUR TABLE SAW
1/2-5/8-3/4" ARBOR
Only **$4.50**

MOULDING CUTTERS only $3.85 per set
CHOICE OF 38 PATTERNS

6 IN. DADO HEADS
CHROME : NICKEL : MOLY STEEL
1/2-5/8-3/4" ARBOR

Cuts 1/8 to 13/16" in steps of 1/16"
2 Hollow Ground Blades
5 Inside Chippers
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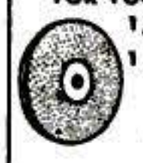
8 IN. SANDING DISCS
FOR YOUR TABLE SAW
1/2-5/8-3/4" ARB.



1 coarse, 1 fine grit on each side
Only **$4.95**

EXTRA SANDPAPER 5 grits 80c
SANDING DISC CEMENT only 40c

SEND CHECK OR M. O. All prices prepaid—WRITE FOR FREE CATALOG S-4

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ORIGINAL "Type P" Pump has 1,001 year 'round uses—home, shop, garden, farm. **DRAINS** cellars, cisterns, wash tubs, ditches, pools. IRRIGATES gardens, lawns, truck patches. **SPRAYS** crops, orchards. **CIRCULATES** oil, coolant. **SUPPLIES** water to elevated tanks from wells as deep as 25 feet. 2400 gals. per hr. capacity. 360 GPH 75' high. 1500 GPH from 25' well. 1" suction and ¾" discharge ports fitted for hose. Use ⅛ to ½ HP motor or engine. ½" Stainless Shaft; Oilless Bearing. **DOES NOT CLOG OR RUST!**

ONLY $6.95
Motor coupling included.

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Easy to Assemble! Easy to Use!

LITTLE GUSHER Irrigates, drains, waters livestock, fights fires! Pumps 2000 GPH 25' high or 360 GPH 75' high. 2 HP engine with 3" power take-off V-pulley. Adjustable from 1700 to 4500 RPM. Portable. Dollar for dollar, pound for pound, the best pump value at **$69.00**
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1½" suction hose, **$1.25** *per foot*
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BIG GUSHER Pumps 7000 GPH. Complete with 3' of 2" suction hose and 2" foot valve, only **$89.00**
2" suction hose, **$1.75** *per foot*
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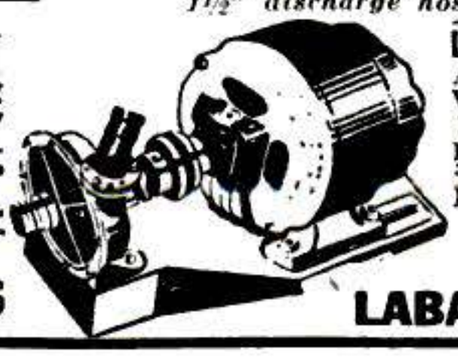
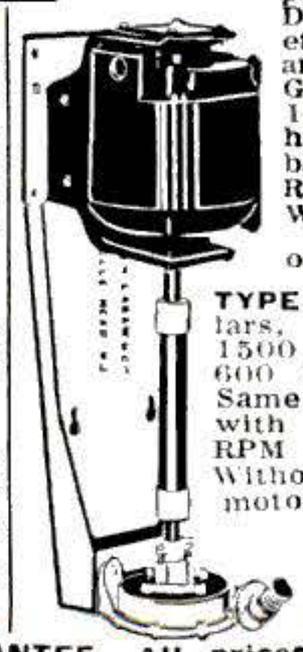
TYPE C-4 Direct drive. Ideal for plumbing fixtures below sewer line. Complete with ¼ HP motor, **$25.95.** Without motor only **$11.25**



LOW-COST ACCESSORIES
All Bronze Foot Valve for 1" hose **$3.45**
1" Suction Hose, per foot ..... .38
¾" Discharge Hose, per foot .. .22



TYPE D-3. Cleans 40' well or cesspool quickly! Drains, Irrigates, etc. Operates in any position. 400 GPH 40' high; 1400 GPH 20' high. With ⅓ HP ball-bearing 3450 RPM motor **$32.95** Without motor, only **$12.85**

TYPE D-4 Drains cellars, pools, boats. 1500 GPH 5' high; 600 GPH 13' high. Same as **D-3,** except with ¼ HP 1750 RPM motor.. **$27.45** Without motor, **$12.85**

AUTOMATIC SWITCH for 24" sump, fits D-3 and D-4, **$4.60.**

MONEY BACK GUARANTEE. All prices **POSTPAID if money order or check with order.** West of Mississippi & Canada, add 50c for Type P; $1.00 for other models.

LABAWCO PUMPS, Belle Mead 4, New Jersey

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Motor driven (not a vibrator). Heavy duty with great power and long life. Adjustable for high-medium or low tone. 110 v. AC current. Weather proof. For alarm or signal horn on boats, school yards, factories, air raid siren, etc. Lists at $47. Our price NEW **$19.95**

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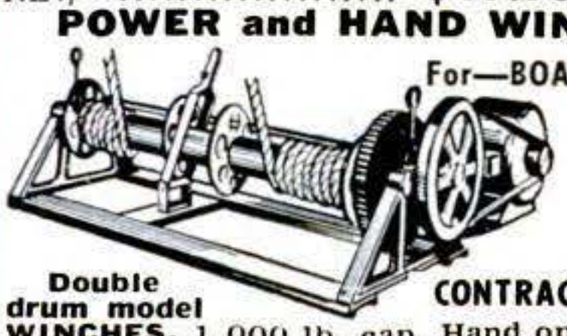

For—BOATS, TRUCKS FARMERS, LOGGERS, CONTRACTORS, ETC.

Double drum model

WINCHES, 1,000 lb. cap. Hand oper. **$ 12.95**
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WINCHES, 6,000 lb. electric drive.. **$188.50**
WINCHES, Single drum, ¾ HP. Motor 110 or 220 AC. Start, stop and reversing switch, belt, pulleys. 100 ft. 3/16" steel cable. 2000 lb. pull. Ratio 12 to 1. NEW **$125.00.** Double drum model..... **$135.00**
CABLE, ¼" preformed stainless steel aircraft, 100 ft. or less..... **17c/ft.**
Over 100 ft..... **15c/ft.**

SAVE OVER 50%

ON THESE BRAND NEW WAR SURPLUS POWER UNITS

BE PREPARED for any emergency!

300 WATT 110-220 volt AC, 60 cycle light plant powered by 1 HP gas engine, direct drive, mounted base, wgt. 40 lbs. Ideal for campers, P.A. systems, house trailers, etc. Equipped with handle for easy carrying **$99.00**
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2000-2500 WATT 110 volt AC, 60 cycle, slow speed generator, 5.10 HP Briggs & Stratton gas engine, NEW..... **$294.50**
To make 110-220 add $40. for transformer.
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NEW **$345.00**

Plants same as above, built in 1951, with tools and spare parts. Lists at $790. Our price **$426.** To make 110-220 add $48 for transformer.

3000 WATT 110-220 volt with push button starter. Starter battery is automatically charged by plant. Gas engine same as in plant above **$465.00**
5000 WATT 120 volt, 60 cycle AC, Hercules 4 cyl. gas engine. Generator mfr'd by Hobart Bros. Unit includes remote control cable, 150' 2-wire #6 and 150' 3-wire #18, exhaust pipe, power cable plug, spare parts, manual, battery, radio and TV filtered. Unit is completely automatic. List price today... $1910. Now priced for you at **$675.** used. **NEW.....$895.** To make plant 110-220 add $72. for transformer.

RUBBER HOSE

Long wearing GOODRICH 2 ply 2" I.D., 25 ft. lengths worth $25. Only **$4.95;** 3 lengths for **$12.00**

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For motor scooters, motor bikes, lawn mowers, etc. Centrifugal action enables electric motors or small gas engines to handle heavy starting loads. 3" A belt pulley. NEW. ⅝" bore **$9.95;** ¾" bore **$10.95;** 1" bore **$11.95**

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(Nothing less than 50 ft.)

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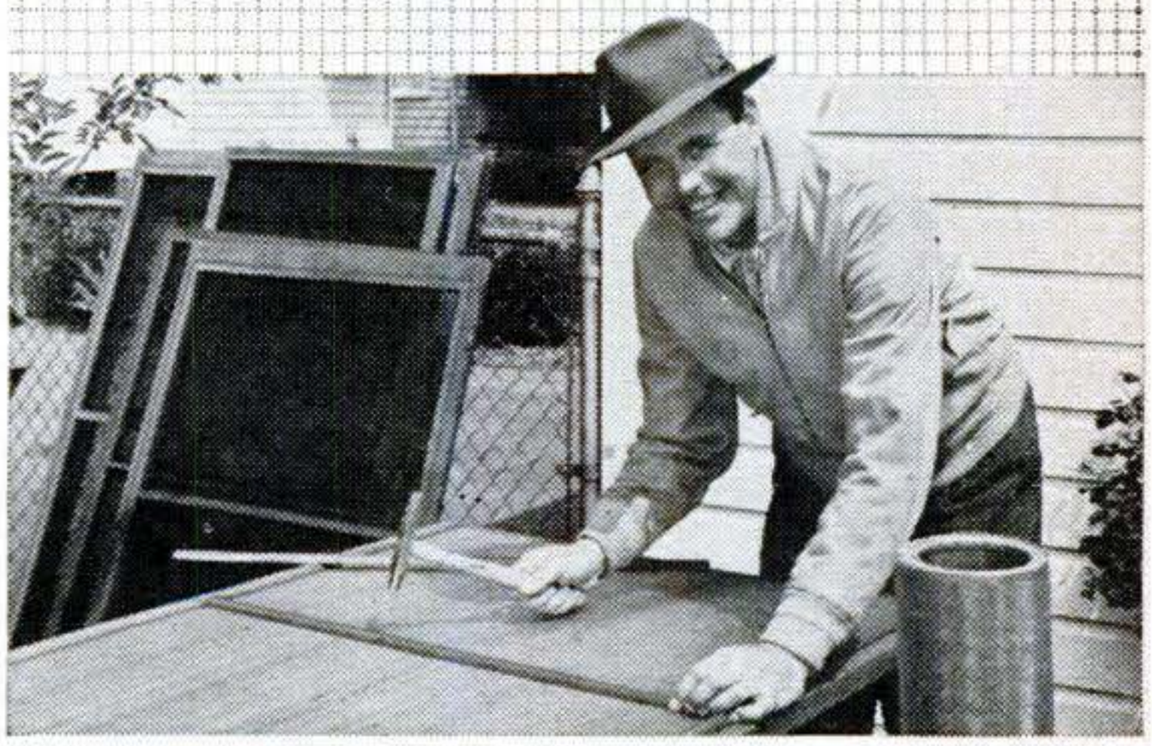

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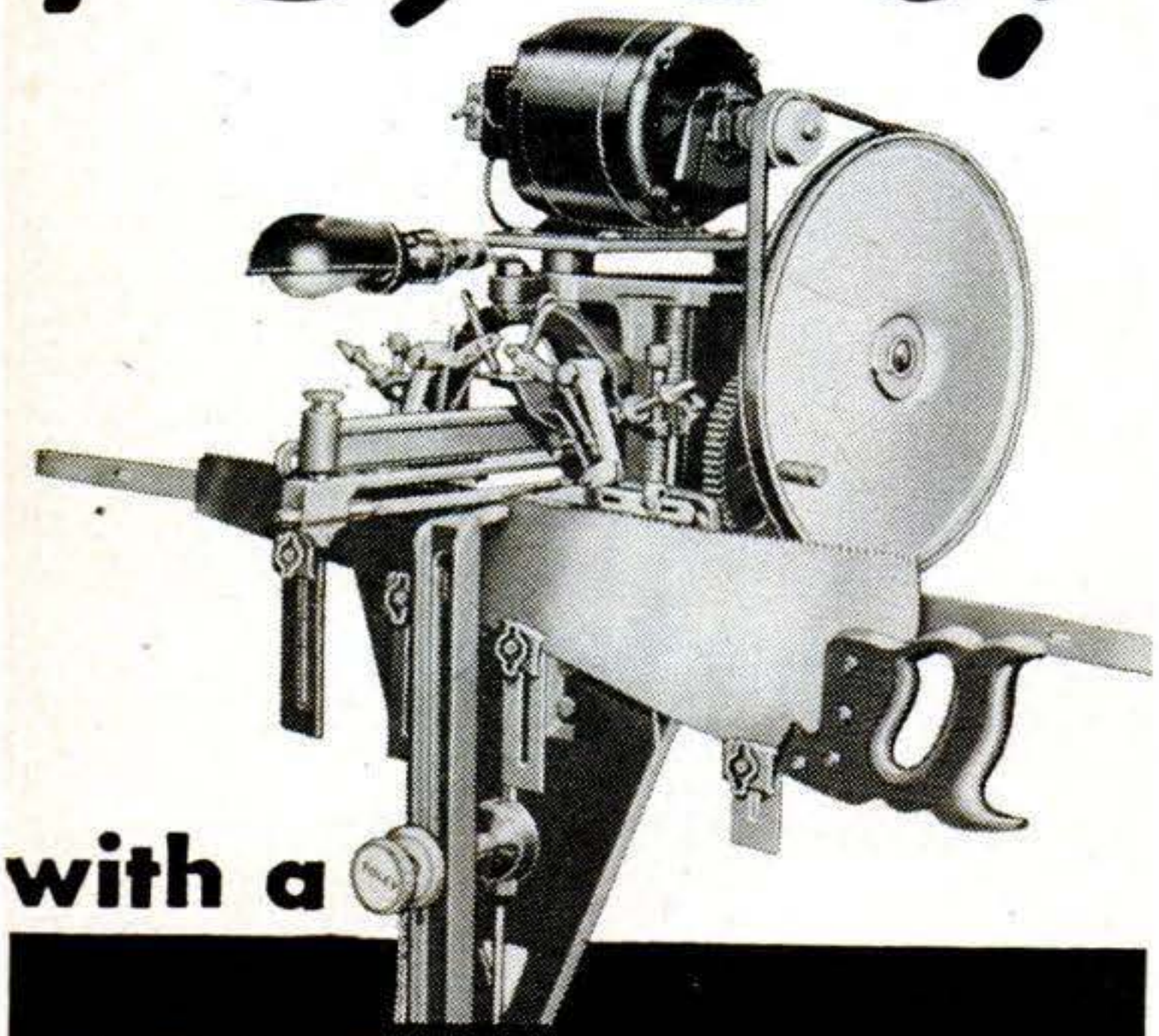

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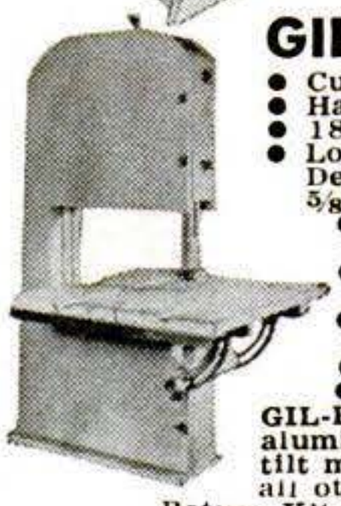

- Cuts to center of 24 inch circle
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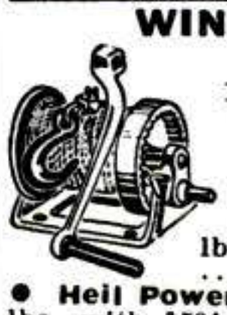

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Paint, blow up tires, control termites, use in shop, etc. Build your own unit.

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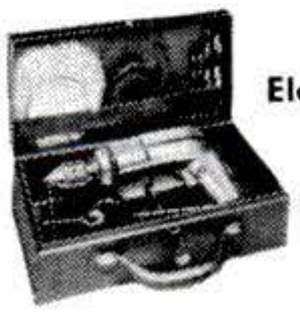

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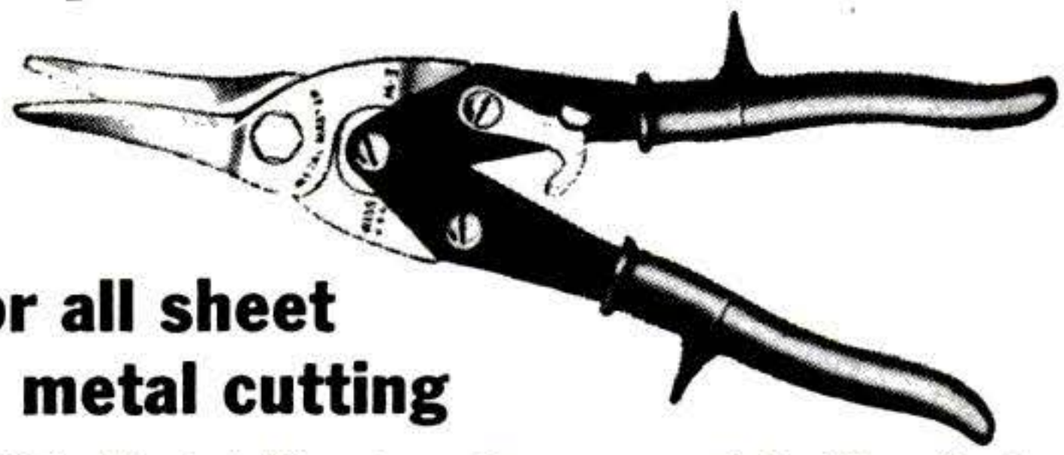

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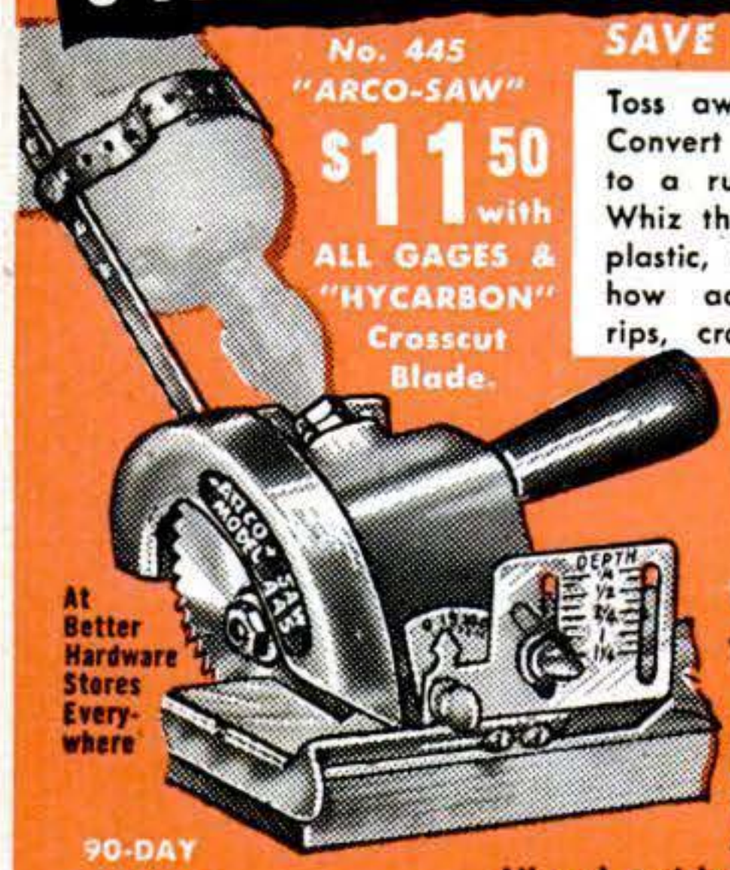

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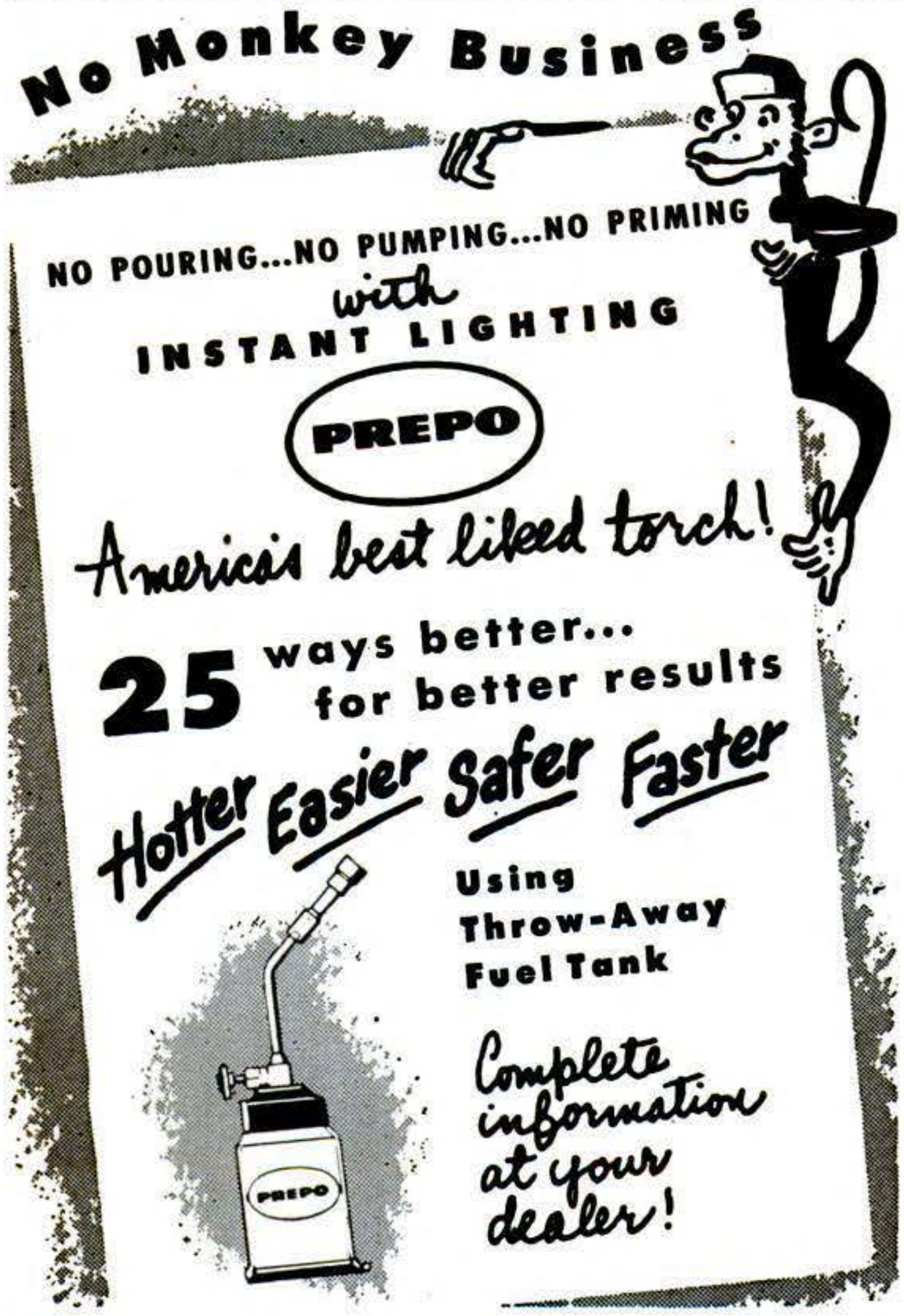

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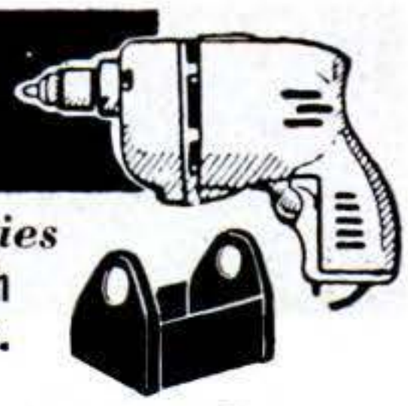

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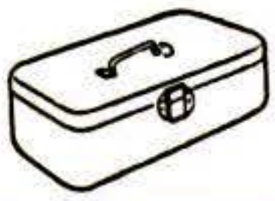

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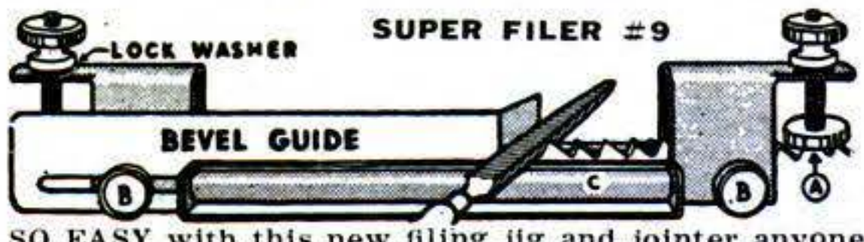

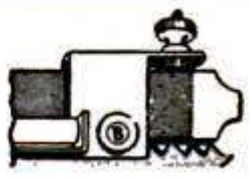

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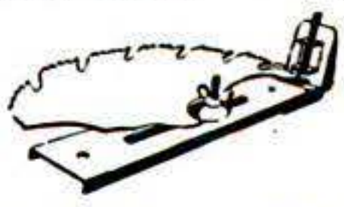

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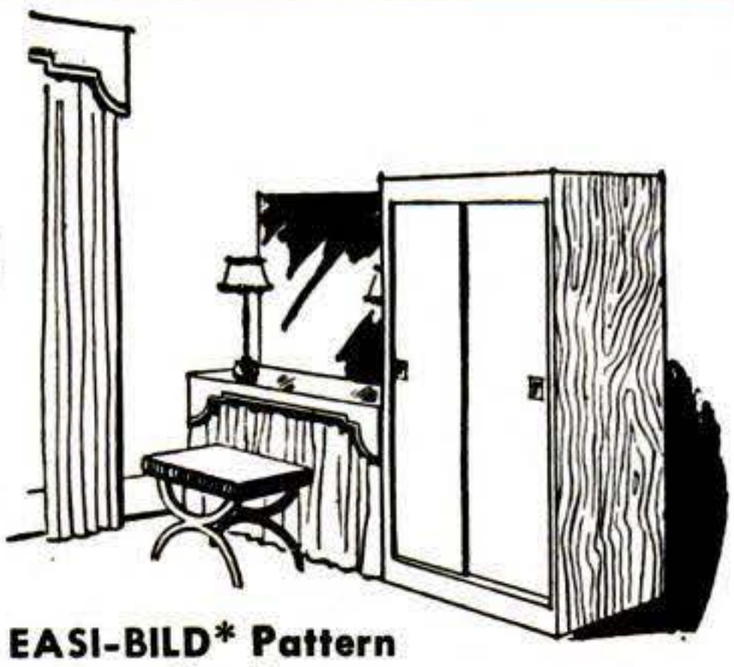

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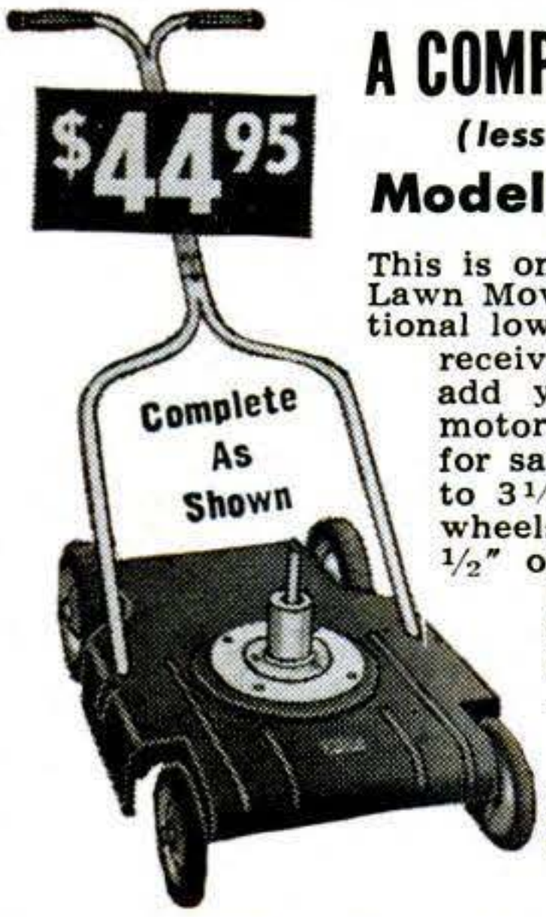

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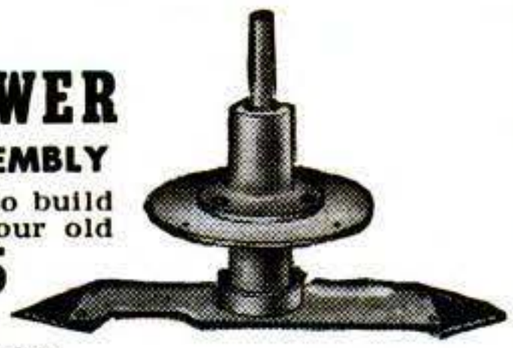

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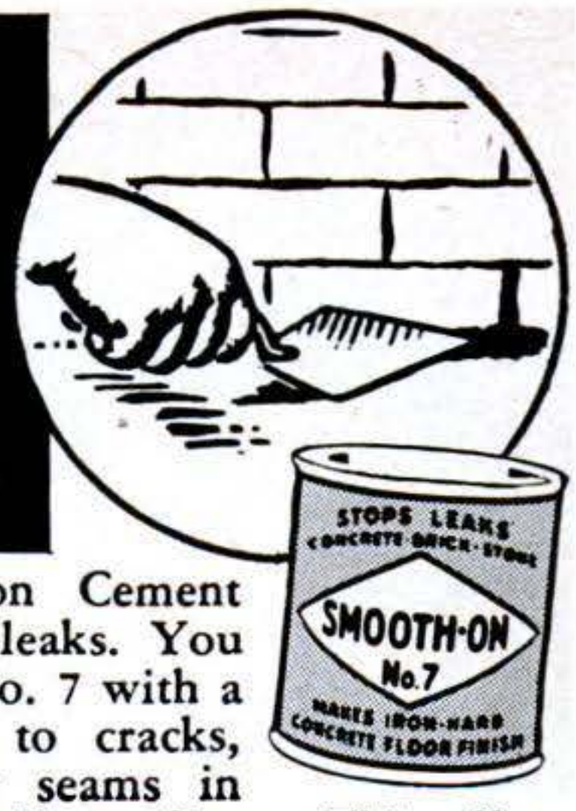

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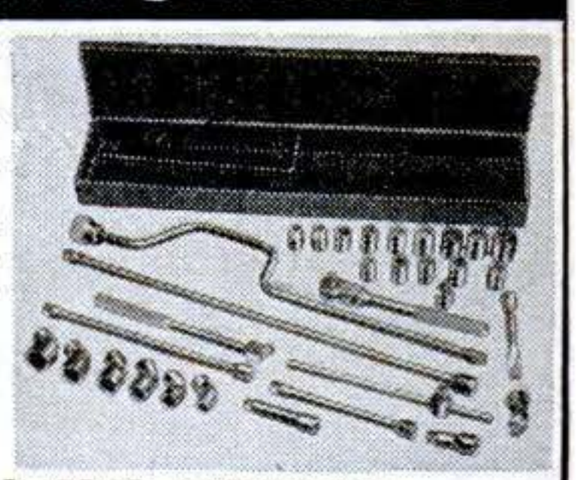

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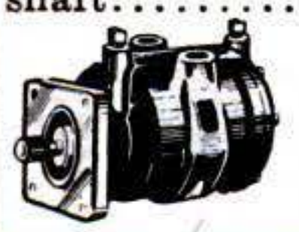

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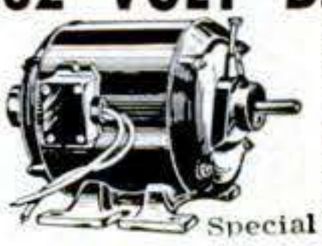

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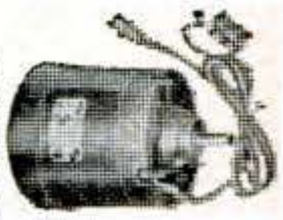

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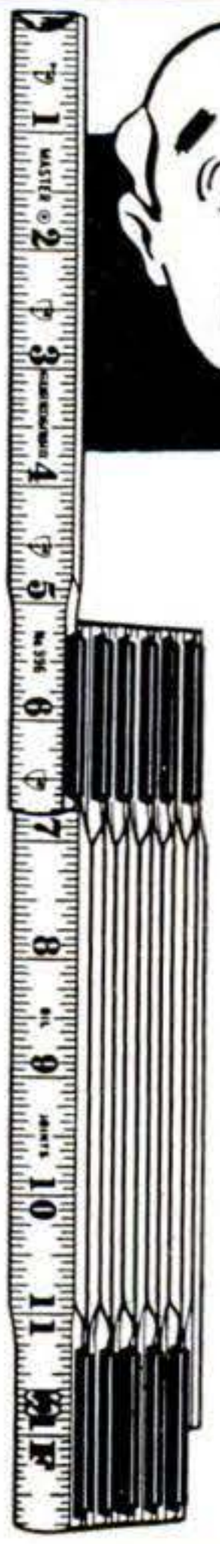

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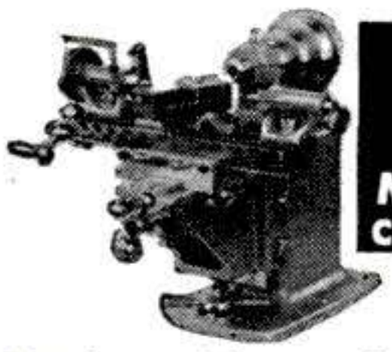

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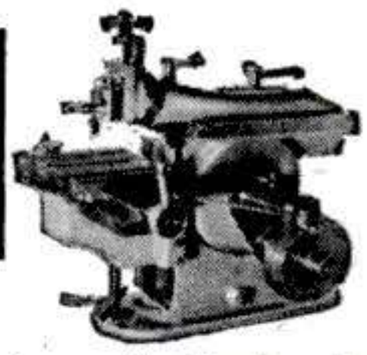

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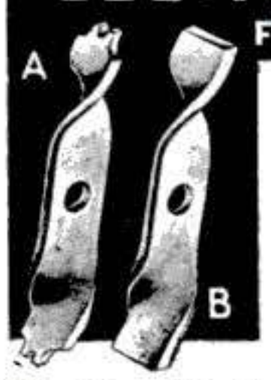

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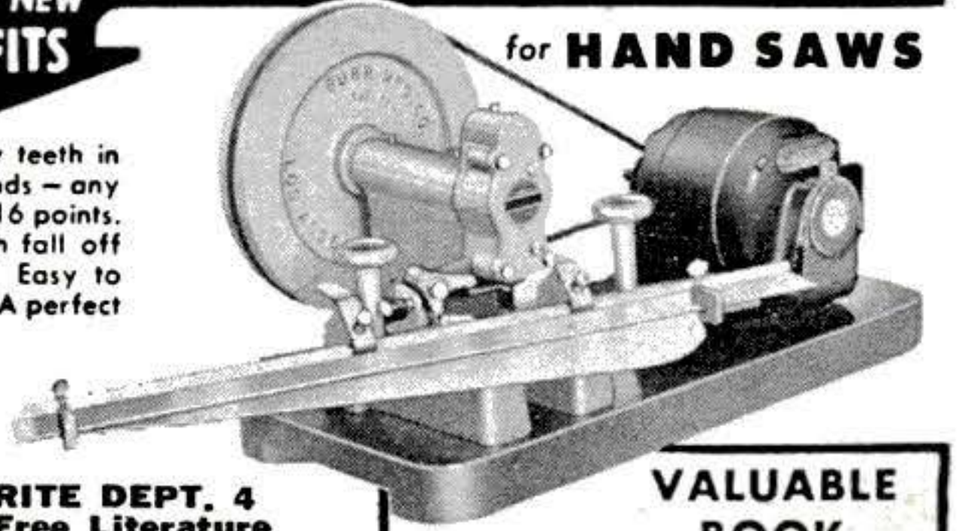

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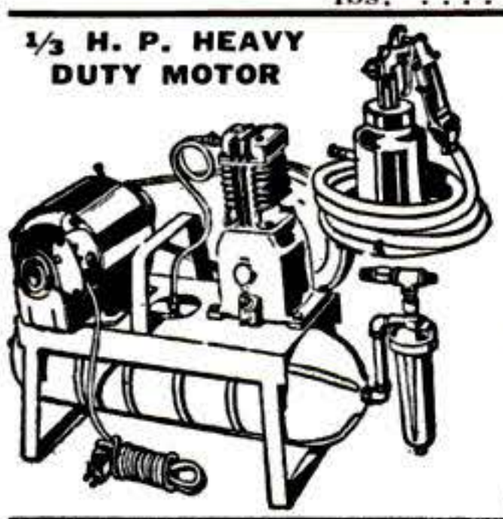

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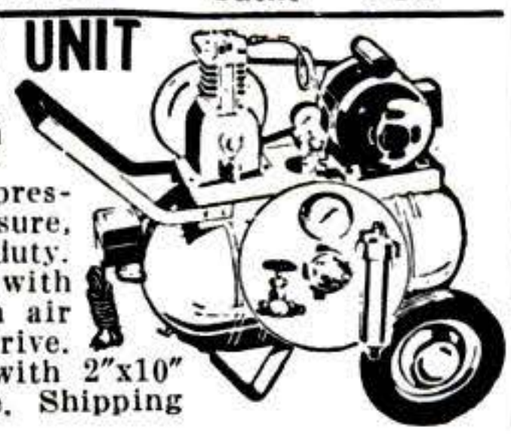
AUTOMATIC COMPRESSOR UNIT



⅓ H.P. heavy duty capacitor motor, AC 110/220 volt, 60 cycle, 2x1¾ inch piston type compressor, splash feed lubrication. 12x24 inch tank, automatic pressure switch. CFM 2.8 at 100 lb. pressure, or 150 lbs. pressure for intermittent duty. Check valve, safety valve, air regulator with gauge and filter, 20 ft. air hose with air chuck for inflating tires. V. belt drive. Mounted on 2 wheels, ball bearing, with 2"x10" pneumatic tires. Portable with handle. Shipping wt. 90 lbs.

With ⅓ h.p. motor. **$160 Value..**	Less Motor.	With 1½ h.p. gas engine...
$98.50	**$79.50**	**$124.50**

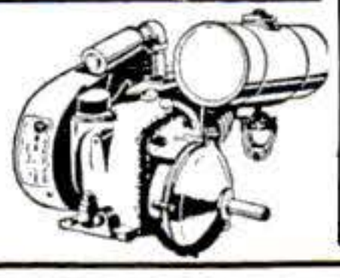
1/12 H.P. MOTOR

Delco 110-V, 60 cy. A.C. 1 phase 1750 r.p.m. 2 amps., will take 50% overload. Shaft 1⅜ x 1¼. Heavy duty, bronze sleeve bearing. 6" long, 5" high. Wt. 12 lbs. List $21.00. Special..... **$13.50**

MERCURY CLUTCH

3" A-belt pulley. Centrifugal action for heavy loads. ⅝" bore. $22.50 list. Special Price **$9.95**

RED SEAL CONTINENTAL GAS ENGINE

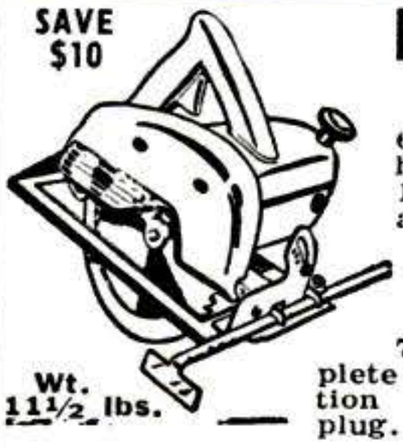


1½ HP with 6 to 1 reduction gear. Operates at 450 R.P.M. For lawn mowers, scooters, garden tractors, pumps, compressors, generators, etc. List Price $79.50. Shipping wt. 54 lbs. SPECIAL PRICE..... **$47.50**

Wellworth BARGAINS

ALL BRAND NEW EQUIPMENT at a GREAT SAVING!

SAVE $10

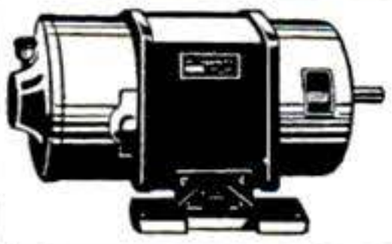


Wt. 11½ lbs.

Portable ELECTRIC HAND SAW

The Zip Sawer With ALL the Features

6¼" Diameter saw blade, ½" square arbor hole. Maximum depth of cut 2⅛". (At 45°, 1¾".) Minimum depth of cut 0°. Angular adjustment 90° to 45°. No-load speed, 5200 r.p.m. Full load speed, 3200 r.p.m. Amperes, full load 8.0. Universal AC-DC motor, 110/220 volt. Dimensions: 11¼" long; 9½" wide (ripping guide removed); 7⅛" high (without blade). Furnished complete with 6¼" diameter combination blade and 10 ft. cord and plug. Wt. 11½ lbs. Price..... **$37.50**



LELAND GENERATORS

2500 to 3000 watts, 110 v. 60 cy. single phase 1800 r.p.m., self excited. Fungus treated for long life. 1951 model. Brand new, in original factory crate. Shipp. wt. 135 lbs. **List $325.** SPECIAL PRICE..... **$225**

LIGHT PLANTS & GENERATORS

2 to 2½ KW light plant, wt. 180 lbs. $365 list, Special.....**$299.50**
Generator only, wt. 75 lbs. **$169.50**
500 WATT GENERATOR, wt. 55 lbs. **$99.50**
5000 to 6000 W GENERATOR, 110/220V. Wt. 225 lbs. **$325.00**
5000 W. LIGHT PLANT, 110/220V. 60 cy. Wt. 575 lbs. **$645.00**

"Wellworth" BLOWER BARGAIN

Quiet operating. Double wheel inlet; double width blower. For heating, ventilating, cooling, air washing, exhausting and forced draft. DIMENSIONS: 10" wheel; outlet 13⅛"x11⅜"; inlet 8¾". Height 19". Width 18". Depth 16½". C.F.M., ¼" S.P. 1600; outlet vel. 1575 Wt. 45 lbs. **BLOWER LESS MOTOR AND DRIVE**..... **$27.50**

With belt and variable speed pulleys, $2.50 extra. Same blower, complete with ¼ h.p. motor, $45.00.

AIR REGULATOR and EXTRACTOR

¼" Air Regulator, Gauge and filter. Wt. 5 lbs.
$8.95

Regulator and Gauge only...
$5.95

½" Kidde Regulator & gauge. list $18.00..... **$12.50**

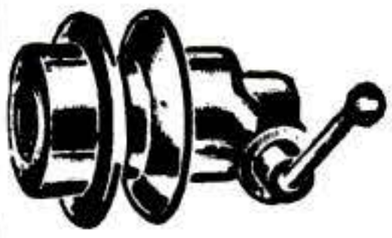
AIR TANK

and Accessories

6"x24" tank, air gauge and chuck, 20 ft. hose, pop-off valve, copper tubing with 4 brass flared fittings, 4 way cross, 3 nipples. **Price $12.45**
Tank Only $6.25

Same outfit as above with 12" x 24" stainless steel tank, 400 P. S. I.
$19.75
Tank Only $14.50

WELLWORTH V-BELT CLUTCH



Takes starting load off engines or motors. When speed is reached, a flip of handle shifts clutch from idling to driving position. Handles "A" belts, 2.35" pitch diameter, ⅝" bore. Ideal for use with lawn mowers, garden tractors, home workshop motors, etc. 3¼" long. Safe, easy to mount, sealed bronze bearings, positive action. Shpg. wt. 3 lbs. **$7.50**
BUSHING FOR ½" SHAFT 15c

SAME CLUTCH FURNISHED WITH ¾" BORE $8.50

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WELLWORTH TRADING CO.

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PLUS a **FEDCO** MADE IN U.S.A.

AT ONLY **$10.95**

Saw-Rite MODEL 605
the ONLY Saw with a ONE YEAR Gear GUARANTEE
and you have the Speediest, Fastest little Power Saw ever to sink its teeth into a piece of wood, plastic, beaver board, wallboard, etc. FULLY ADJUSTABLE... any DEPTH from 1/8 to 1 1/8 inches... any BEVEL angle from 0 to 45 degrees... has accurate RIP-GAGE edge guide. CUTS CLEAN and TRUE • RIP or CROSS • DADOES and GROOVES EASY ONE HAND OPERATION LEAVES A FINISHED PROFESSIONAL LOOKING JOB
An Indispensable Workshop Tool ...Does a Man's Size Job, yet small enough to Fit a Tool Box. Smooth, high-torque mitre-drive, quick-acting and free of back-lash ...chrome nickel steel, dynamically balanced blade...one-piece aluminum housing...Oilite bearings ...hardened shafts...coppo-steel gears...EXCLUSIVE quick-clamp connecting yoke...clear-view visible cutting guide...AND every other Feature for Comfort, Safety and Ease of Operation.

COMPLETE with Combination 4 inch Blade and Fully Adjustable Bevel-Tilt-Depth Rip Gage.

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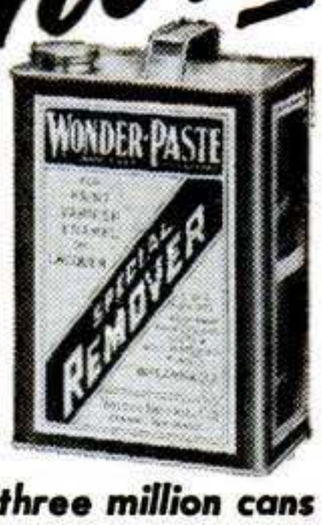
#504C Combination $2.00
#504R Rip-Set $2.00
#504M for Soft Metals ... $3.00

Dealers: Write for Nearest Jobbers.

FEDERAL ENGINEERING CO., S42 37 Murray St., N Y 7, N. Y.

Removing paint?



You'll be glad you tried WONDER-PASTE—the time-tested paint remover used by professional painters. Just apply it over any paint, enamel, varnish or lacquer and let it penetrate. Then see how *easily* you can strip off the old finish! No hard scraping or sanding. *Won't run* on upright surfaces. At leading paint and hardware stores.

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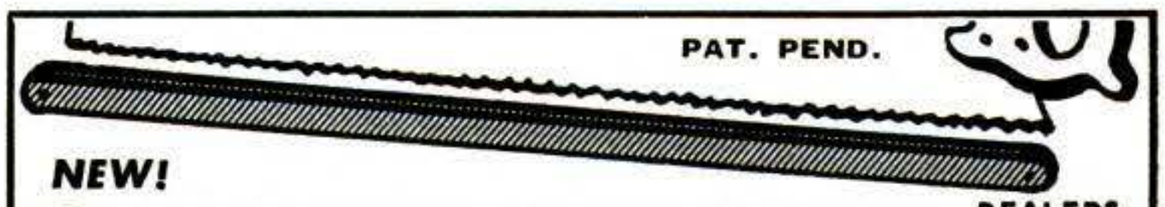

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CARPENTERS SAW GUARD DEALERS WANTED
PROTECTS TEETH • KEEPS SAWS SHARP
Easy to put on—take off. Fits any standard (26") saw
Only $1 Postpaid. Money Back Guarantee
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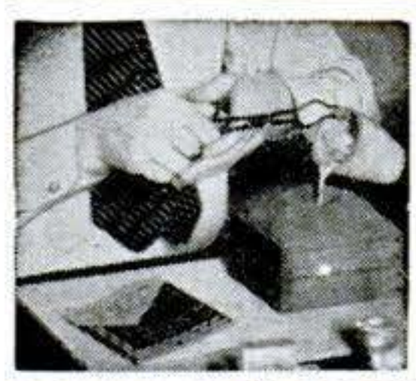

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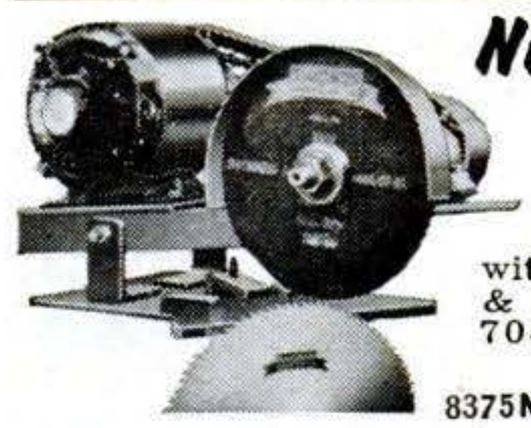

NEW Saw Sharpener

Improved #64 Hand Gummer sharpens all types circular saws 4" to 20" diam. Ideal for saw shops. Self-Centering adjustment for quick, easy set-ups. Complete with 1/4 HP motor, 1 grinding wheel & cord. **$79.50** FOB Portland. Wt. 70#. SEND FOR FREE LITERATURE.

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SHEET METAL BRAKES

Forms angles, flanges and Pittsburgh locks. 26 gauge steel, heavier aluminum. Cam locking. Portable, can be bolted to bench, or clamped to edge of truck. All steel, reinforced. Shipped Exp. Coll. 30" size. Wt. 54 lbs., **$26.50.** 36", Wt. 66 lbs. **$31.00.** 48", Wt. 100 lbs., **$45.00.** Floor mountings, portable, 32" high, 30 lbs., **$7.00.** 12" **BRAKE.** Fits in vise to form difficult compound bends, up to 20 gauge steel. Not illustrated.....**$12.50 P.P.**

IRON BENDER. Forms hooks, angles, eyelets, etc. Capacity, 1/4x2", 5/16x1 1/2". 10 parts all steel.....**$10.00 Post P.**

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WELD BRAZE, SOLDER, and CUT → ONLY $14.75 F.O.B. complete!

No experience needed. Follow simple instructions, weld on iron, steel, bronze, brass, aluminum, and other metals. Plugs into any properly wired 110 volt A.C. or D.C. line. Make or save time and money doing repair work for yourself and others. Repair men, farmers, tinsmiths, home and auto owners, hobbyists, etc., say FOUR-WAY pays for itself over and over. Order today or send for Free details.

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LARGER EQUIPMENT AVAILABLE ON REQUEST

Make your lawn furniture look like new!

Protect, preserve, beautify children's playground equipment, garden tools, metal screens

If you prize it—"KRYLON-*ize*" it!

Take Krylon Acrylic coating outside with you—and, next fall, your prized possessions will be as fresh and bright as you make them this spring! "Krylon-izing" seals out water, air, moisture, dirt. Rustproofs metal. Practically banishes wear and tear on almost any metal, wood, leather, paper object. So easy to use—just press a button, spray it on. Dries quickly, lasts indefinitely. Waterproof, non-flammable. Won't change color, crack or dry out. You clean "Krylon-ized" objects with the touch of a damp cloth.

CRYSTAL CLEAR, BRIGHT WHITE, ALUMINUM

Clear is transparent as glass. Colors last longer, clean easier, are easier to apply than paint or enamel. Get all of them at your hardware counter in 12 oz. aerosol spray cans.

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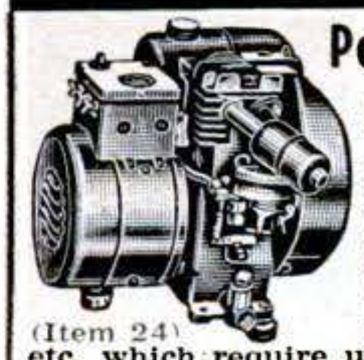


Portable LIGHT PLANT

PUSH BUTTON START

(Item 24) 500-700 watts 110-120 v. — 60 cyc. A.C. Powered by a sturdy dependable, easy starting, air cooled 1¾ hp. gas engine. No wiring necessary, just plug in and operate. Plenty of current for any oil burner, freezer, brooder, pump, emergency lights, etc. which require up to 700 watts. Ideal for Civil Defense, Fire Depts; trailers & camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Wt. 85 lbs. Fully guaranteed. **Be prepared if war or storm knocks out power lines.**

Reg. $275.00 value..... **$143.50**

700-800 Watt Plant (Item 44) Same as above but greater output. **$169.95**

1000-1200 Watt Plant (Item 45) same as Item 24, but larger generator & engine..... **$199.50**

GIANT 2000-2500 WATT PLANT

(Item 31) 110-120 V. 60 cyc., A.C. **Absolutely the best made**—exclusive dynamically balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid-mounted — portable. Powered by easy starting Briggs or 6 hp. Wisconsin engine —complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty and instructions included. Wt. 220 lbs. Reg. $585.00. Special at... **$299.50**

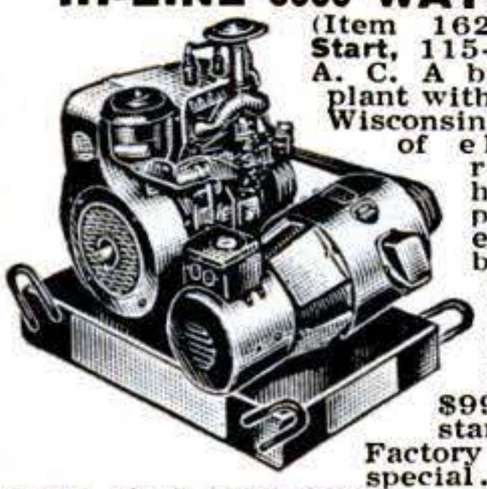
With Electric Self Starter (Item 179) **$359.50**

GENERATOR ONLY and control box. Drive it with your engine or tractor.. **$169.50**

TRANSFORMERS—(Item 197) Convert 110 v A.C. to 220 v. Capacity 2 kva. Simple hook-up. Regularly $55. Our price—when purchased with light plant..... **$27.50**

Purchased separately $34.50.

HI-LINE 6000 WATT PLANT



(Item 162) **Push Button Start,** 115-230 v. 60 cycle A. C. A brute of a power plant with a rugged 13 hp. Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Affords both 110 and 220 volts. Ideal where heavy current is needed. Wt. 590 lbs. Easily worth $995.00. (with self starter)

Factory special..... **$645.00**

Same plant (with crank starter) (Item 166) Wt. 570 lbs.... **$585.00**

Generator and control box only, belt driven. Use your engine or tractor. Wt. 240 lbs..... **$345.00**

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IMMEDIATE DELIVERY—ALL ITEMS

HEAVY DUTY D-C ARC WELDER

(Item 38) Use as portable or shop welder. Up to 300 amps. Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Easily welds up to ¾" plate using ¼" rods. Built-in air-cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 15 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and double V belt or flat pulley. You can pay more, but you can't buy a better welder. Wt. 110 lbs.

A $400 value at..... **$99.75**

DUAL CONTROL MODEL same as above but with built-in dual rheostat for low heat soldering, brazing and welding. Special..... **$119.50**

WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at.... **$10.50**

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range, removes kitchen smoke and odors. Powerful continuous duty motor, 110-120 v. A.C. Quiet, super efficient fan moves huge volume of air (400 to 600 c.f.m.) 8" Fan, wt. 5 lb. **$6.35**; 9" Fan, wt. 6 lbs. **$7.45**; 10" Fan, wt. 7 lb. **$8.45**; 12" Fan, wt. 8 lbs. **$9.45.**

TRENCH-LAY WIRE (Item 191) #14-2 Cond. — for buried service to lights, etc. Absolutely impervious to soil or moisture. Each conductor consists of two #17 solid wires encased in tough Neoprene. Twist ends together for #14 cap. Min. order 100 ft., Wt. 7 lbs. Terrific bargain. **8c** per ft.

EXTENSION POWER CABLE #12-2 Cond. — stranded, flexible, rubber covered and shielded: with heavy duty plug and outlet; finest power cable made. 50 ft. (Wt. 8 lbs.) **$6.95**; 100 ft. (Wt. 16 lbs.) **$12.95.**
#8-2 Cond.—rubber cov.—50' lgth. **$20.** #4-2 Cond.—rubber cov.—50' lgth. **$27.**

EXTENSION CORD

(Item 16) 40 ft. **heavy duty,** made of specially insulated No. 14 2-conductor wire. So tough that you can drive over it and yet flexible and easy to handle. Resists oil, grease or water. Extends electricity up to 400 ft. without voltage drop. Use indoors or out. Complete with heavy rubber plug and outlet. Wt. 2½ lbs. Usually $4.50—Special 40 ft. **$1.99**
Comb: 2-40 ft. and 1-20 ft. (total 100 ft.) **$4.95**
100 foot length (one piece)..... **$4.85**
WIRE ONLY (Item 50) No fittings, 100 ft. **$4.00**

COMMANDO BIKE MOTOR

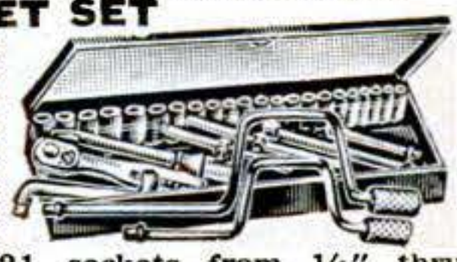
(Item 90) **New, super-modern 1952 model. This job is the Cadillac of all bike motors. Sensational Auto-Clutch prevents** killing motor **at each stop.** Also selects **proper** ratio **on** hills. **Mounts** behind and drives **rear** wheel with Dynarotor. Free Wheeling lever permits pedalling if desired. Rear Mounting eliminates fumes, **heat,** dirt, and hard steering. Easily installed **in 15** minutes with home tools. Sturdy, trouble-free, **easy** starting, light weight. Airplane type **engine; up** to 150 miles per gallon. Fully guar. **Ride for** fun **or** profit. Ideal for deliveries, **paper routes,** messenger **service,** etc. Ride **to work and save. Dealer inquiries** invited.

The Commando Captain, 1 cylinder 1½ hp. **$99.75**

The Commando General, 2 cylinder 3 hp. (Item 91)..... **$125.00**

All Commandos shipped prepaid in U.S.

32 pc. SOCKET SET



32-pc. Socket Set (Item 59) Highest quality guar. non-breakable sockets made by Husky. Beautiful, matched chrome alloy, absolutely the best. Complete range of 21 sockets from ¼" thru 7/16" in ¼" drive and 7/16" thru 1-1/16" in ½" drive; 2 extensions, reversible ½" ratchet, adaptor bit, slide head, all angle coupling, 2 end wrenches, ¼" speeder handle and sturdy metal tool box. For prof. mechanics who want the best. Wt. 14 lbs. Easily worth $41.50. While they last. **$16.95**

POTTERS WHEEL

(Item 47) Complete prof. equip. for making finest ceramics and pottery. **New design,** larger, non-breakable, Alemite bearings. Large dynamically balanced cast-aluminum reversible turntable with variable speed drive (38 to 140 rpm) controlled by foot-pedal. Built-in adjustable arm rests, water cup and wedging wire. 18x18" enclosed throwing table—ample area for largest pieces. Req. ¼ hp. motor (not incl.). Complete with pulleys, belts and instructions. Wt. 26 lbs.

$145 value at..... **$59.95**

Westinghouse ¼ h.p. motor for above..... **$19.50**

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6-PIECE WOOD-BORING SET

4 Blades, Shaft, Screw Key

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Bits **are of BLUE SPRING STEEL** Tempered - rugged - sharp cutting edges that bore clean, smooth, accurate holes. Extra Blades only 69c each.

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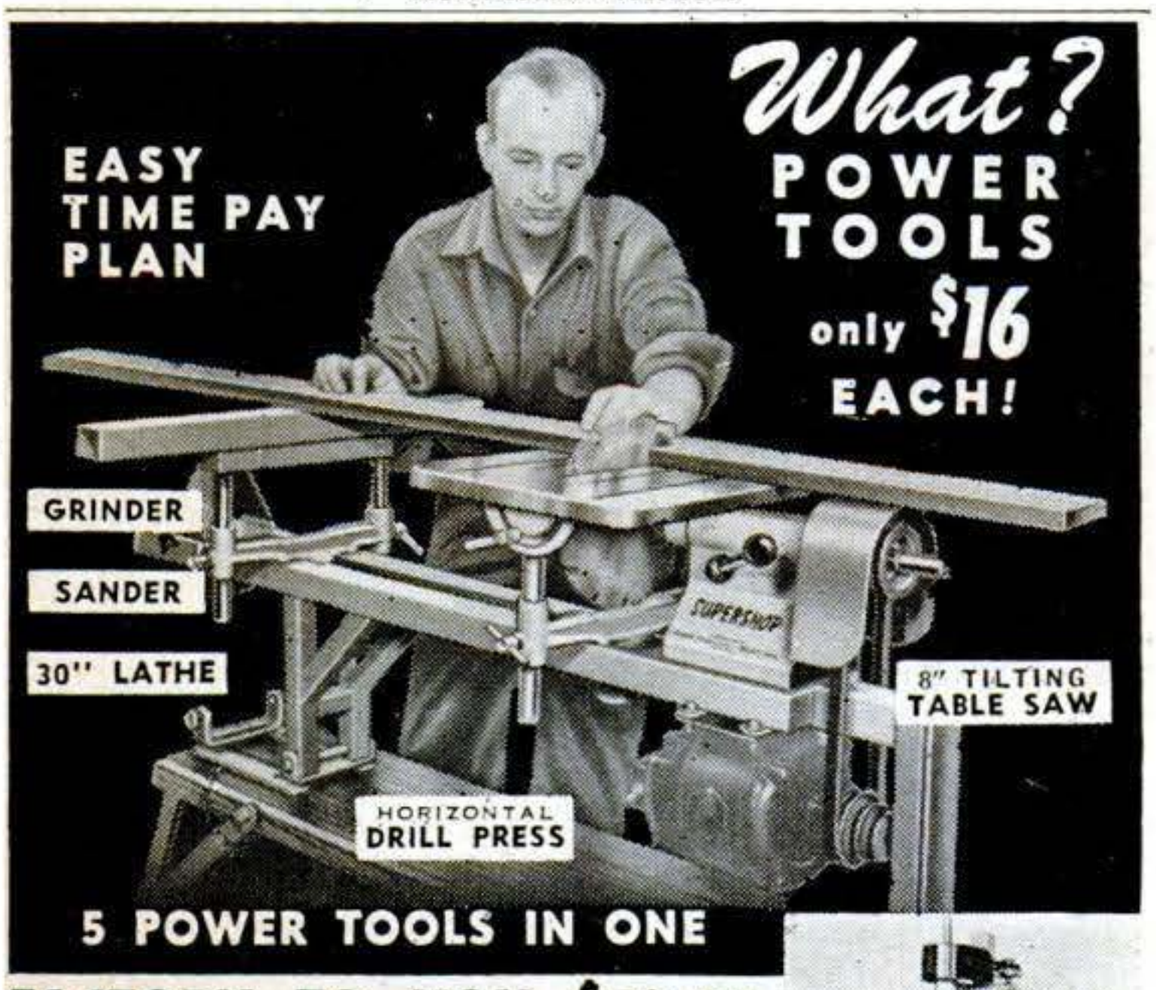

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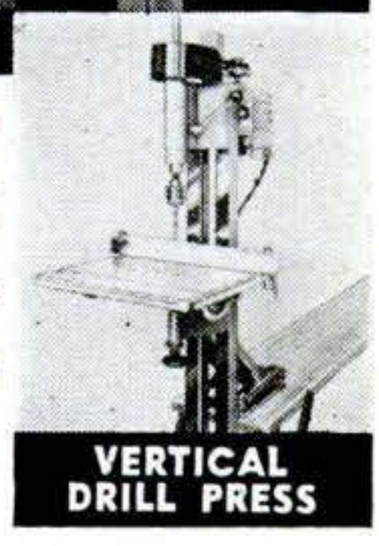

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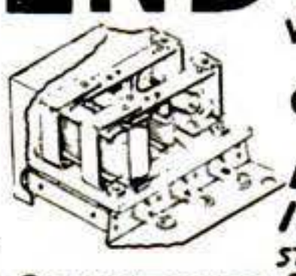

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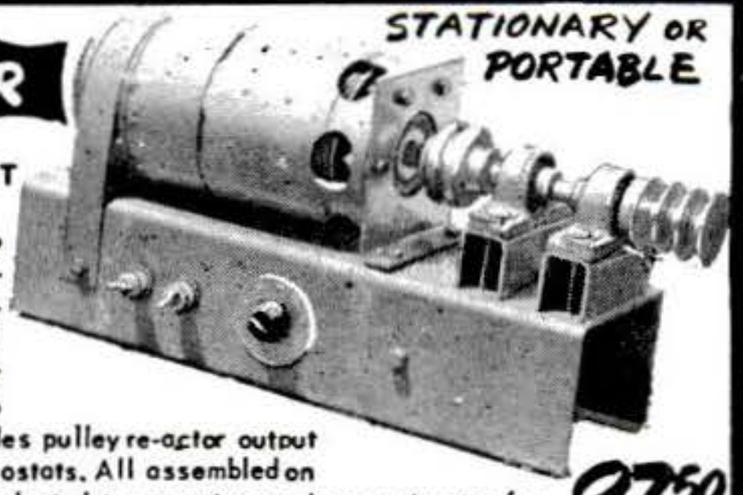

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[*Continued from page 173*]

out an Indian motorcycle which he had built up in his Illinois shop to a displacement of 80 cubic inches. He kicked down on the starter, the hind wheel bit into the sand and he was off on a mile that timed out at 88. A Hudson Pacemaker made an average for both directions of 88.96, a '52 Chrysler averaged 100.09, a '51 V-8 Studebaker 95.52, and a '51 Packard 98.22, the last mentioned getting up to a shade over 101 on the downwind run.

And to cap these demonstrations, another XK 120 Jag laid down a run south at 122.20 m.p.h., with a two-way average of 119.83. This Jaguar sounded a loud power note and had evidently more punch than the others, presumably as a result of the higher compression ratio and other accompanying options offered by Jaguar cars. None of the Jaguars was equipped with the streamlining underbody tray, which is available from the makers and which is said to provide an extra five to 10 miles an hour by shielding off the windtraps beneath the car. Several ran with full windshields, license plates and bumpers. It is worth noting that the fastest of the lot carried a low Plexiglas shield in front of the driver only.

Chrysler-Powered Ford

One of the most interesting cars was the new Ford sedan with a Chrysler engine, which Bill Frick of Baldwin, L. I., brought out on the sands. His timed mile was variously reported at 112 and 114. Frick, widely known for his "Fordillac" and his work as mechanic on the Cadillac engines used by Briggs Cunningham in France and Great Britain, was using a hand gearshift, a standard compression ratio of 7.5 to 1, and a 3.21 rear axle—a considerably higher gear than most Ford-Mercury units can pull comfortably without too much sacrifice of acceleration. He estimated that the conversion increased the weight of the Ford sedan by about 250 pounds, against which the Chrysler, at 4,500 r.p.m., represented a horsepower gain of 70. On that basis Frick's takeoff from a standing start would certainly prove troublesome for any of the Jaguars, or indeed for any other car fully equipped for road driving.

Profitable speeds on the lower gears, Frick estimated, were up to 50 in first and 90 in second. He had tried a 4.11 ratio but had lost more on wheel spin than he gained with the added punch. There is little to choose, according to Frick, between Cadillac and Chrysler engines for use in a Ford. The Cadillac unit is much lighter, weighing little more than Ford's engine, its torque at low engine speeds is prodigious, and it is probably the most velvety engine of anything like comparable power on the road today. But even with a 3.21 rear end, Frick's Chrysler-powered car accelerated with a rush, in high gear, from as little as 15 m.p.h.

Stock Engines for Track Races?

Both Cadillac and Chrysler engines appeared elsewhere in the Daytona speed trials mounted in out-and-out track-racing cars, and the mile runs in this new "speedway division" illustrated what stock, or modified-stock, engines can produce with cars weighing around 2,000 pounds. The Cadillac unit's mile was timed unofficially at 142.29, the Chrysler at 131.43, a Hudson at 122.28 and a Ford at 131.58. It seems probable that a good many race cars thus equipped will be seen around the circuits in future meets, for a car of this class can be put together for some thousands less than the cost of the so-called "big cars"—as differentiated from midgets—of the Indianapolis type.

American automobile manufacturers are still somewhat reluctant to expose their products to miscellaneous racing under the auspices of private promoters. Racing, after all, is a specialty in its own right. The successful race car usually results from the special abilities of the men who develop it and put it together, the same men who, as often as not, drive it in competition. The great motor companies are specializing in the mass production of cars for a variety of other uses, and the two specialties do not blend as readily as they did 30 or 40 years ago.

Yet it is a healthy thing that mechanics, speed fans and filling-station men all over the land are forever trying to go Detroit one better. If an American wants a high-powered engine in a lightweight car, there is no real reason why he should have to cross the Atlantic to buy one. A sampling of Nascar's races will leave anyone with the impression that large numbers of Americans have a lively interest in something more than "sleek new styling" and "smart new interiors" for their cars. END

Next month: How Murrell Belanger builds the cars that win the Indianapolis 500.

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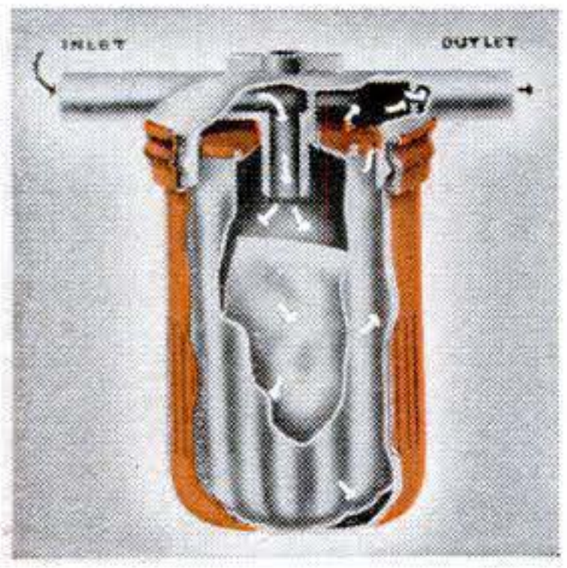

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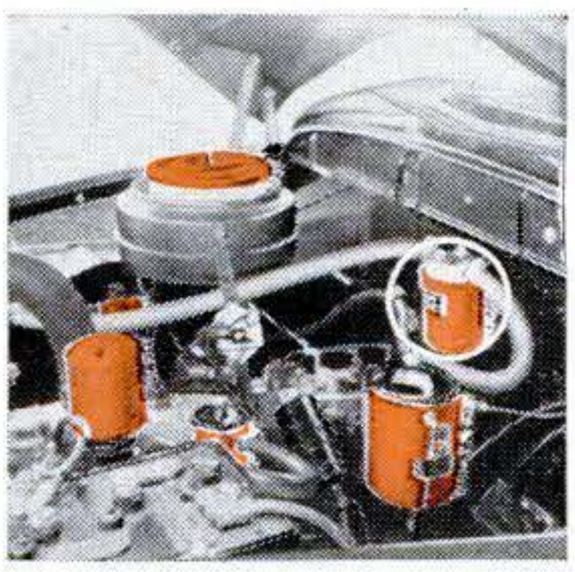

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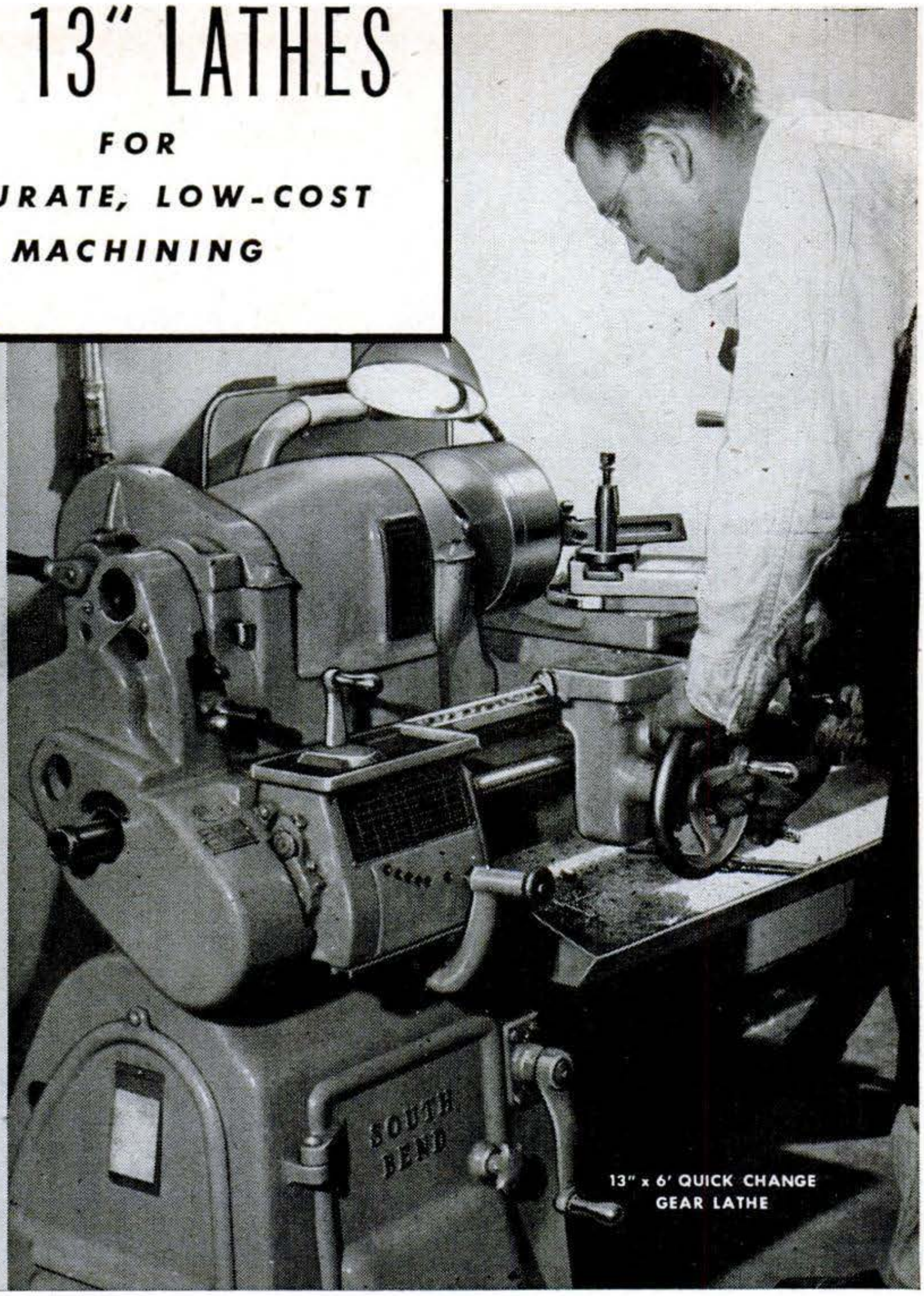
CROSS SLIDE TRAVEL: 8-1/8 in.

TAILSTOCK SET-OVER: . 15/16"



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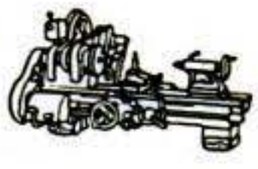

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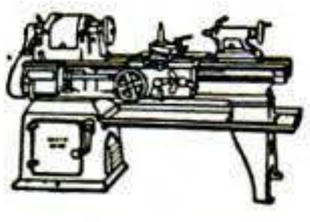

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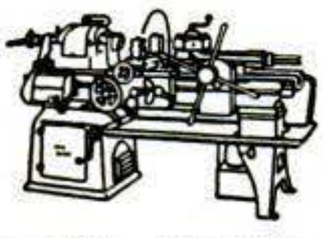

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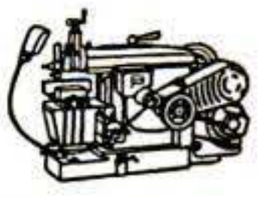

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